EXHIBIT 22

U.S. Fish and Wildlife Service

Florida Panther

Recovery Plan

Photo by Mark Lotz, Florida Fish and Wildlife Conservation Commission

3rd Revision

EXHIBIT 22

FLORIDA PANTHER RECOVERY PLAN

(*Puma concolor coryi*)

THIRD REVISION

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Prepared by

The Florida Panther Recovery Team

and

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

for

U.S. Fish and Wildlife Service
Southeast Region
Atlanta, Georgia

Approved: Sam D. Hamilton
Regional Director, U.S. Fish and Wildlife Service

Date: November 1, 2008

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Many people contributed to this revision, and some spent countless hours working on specific sections. The Overview and much of the Background Sections were initially written by John Kasbohm. Parts of the Background Section were updated and added to by Chris Belden, Mark Cunningham, Elizabeth Fleming, Paula Halupa, Laura Hartt, Karen Hill, Nick Kapustin, Darrell Land, Laurie Macdonald, Roy McBride, Tim O'Meara, Cindy Schulz, and Wes Woolf. The Recovery Strategy was drafted by Laura Hartt and Karen Hill with assistance from Larry Richardson, Wes Woolf, and Steve Williams. The Recovery Action Outline and Narrative Section and Implementation Schedule were a Team effort, but specific parts were provided by Kipp Frohlich, Margaret Trani (Griep), Tim O'Meara, and Karen Hill. Karen Hill provided the majority of the Public Awareness and Education parts of these sections.

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EXECUTIVE SUMMARY

Current Species Status

The Florida panther is the last subspecies of *Puma* still surviving in the eastern United States. Historically occurring throughout the southeastern United States, today the panther is restricted to less than 5% of its historic range in one breeding population located in south Florida. The panther population has increased from an estimated 12-20 (excluding kittens) in the early 1970s to an estimated 100 - 120 in 2007. However, the panther continues to face numerous threats due to an increasing human population and development in panther habitat negatively impacts recovery. The panther is federally listed as endangered (see Appendix A for definitions) under the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) and is on the State endangered lists for Florida, Georgia, Louisiana, and Mississippi. The panther has a recovery priority number of 6c.

Habitat Requirements and Limiting Factors

Panthers are wide ranging, secretive, and occur at low densities. They require large contiguous areas to meet their social, reproductive, and energetic needs. Panther habitat selection is related to prey availability (i.e., habitats that make prey vulnerable to stalking and capturing are selected). Dense understory vegetation provides some of the most important feeding, resting, and denning cover for panthers. Telemetry monitoring and ground tracking indicate that panthers select forested habitat types interspersed with other habitat types that are used in proportion to their availability.

Limiting factors for the Florida panther are habitat availability, prey availability, and lack of human tolerance. Habitat loss, degradation, and fragmentation is the greatest threat to panther survival, while lack of human tolerance threatens panther recovery. Panther mortality due to collisions with vehicles threatens potential population expansion. Potential panther habitat throughout the Southeast continues to be affected by urbanization, residential development, road construction, conversion to agriculture, mining and mineral exploration, and lack of land use planning that recognizes panther needs. Public support is critical to attainment of recovery goals and reintroduction efforts. Political and social issues will be the most difficult aspects of panther recovery and must be addressed before reintroduction efforts are initiated.

Recovery Strategy

The recovery strategy for the Florida panther is to maintain, restore, and expand the panther population and its habitat in south Florida, expand this population into south-central Florida, reintroduce at least two additional viable populations within the historic range outside of south and south-central Florida, and facilitate panther recovery through public awareness and education. The panther depends upon habitat of sufficient quantity, quality, and spatial configuration for long-term persistence, therefore the plan is built upon habitat conservation and reducing habitat-related threats. Range expansion and reintroduction of additional populations are recognized as essential for recovery. Similarly, fostering greater public understanding and support is necessary to achieve panther conservation and recovery.

Recovery Goal

The goal of this recovery plan is to achieve long-term viability of the Florida panther to a point where it can be reclassified from endangered to threatened, and then removed from the Federal List of endangered and threatened species.

Recovery Objectives

1. To maintain, restore, and expand the panther population and its habitat in south Florida and expand the breeding portion of the population in south Florida to areas north of the Caloosahatchee River.

2. To identify, secure, maintain, and restore panther habitat in potential reintroduction areas within the historic range, and to establish viable populations of the panther outside south and south-central Florida.

3. To facilitate panther recovery through public awareness and education.

Recovery Criteria

Reclassification will be considered when:

1. Two viable populations of at least 240 individuals (adults and subadults) each have been established and subsequently maintained for a minimum of twelve years (two panther generations; one panther generation is six years [Seal and Lacy 1989]).

2. Sufficient habitat quality, quantity, and spatial configuration to support these populations is retained / protected or secured for the long-term.

A viable population, for purposes of Florida panther recovery, has been defined as one in which there is a 95% probability of persistence for 100 years. This population may be distributed in a metapopulation structure composed of subpopulations that total 240 individuals. There must be exchange of individuals and gene flow among subpopulations. For reclassification, exchange of individuals and gene flow can be either natural or through management. If managed, a commitment to such management must be formally documented and funded. Habitat should be in relatively unfragmented blocks that provide for food, shelter, and characteristic movements (e.g., hunting, breeding, dispersal, and territorial behavior) and support each metapopulation at a minimum density of 2 to 5 animals per 100 square miles (259 square kilometers) (Seidensticker et al. 1973, Logan et al. 1986, Maehr et al. 1991a, Ross and Jalkotzy 1992, Spreadbury et al. 1996, Logan and Sweanor 2001, Kautz et al. 2006), resulting in a minimum of 4,800 – 12,000 square miles (12,432 – 31,080 square kilometers) per metapopulation of 240 panthers. The amount of area needed to support each metapopulation will depend upon the quality of available habitat and the density of panthers it can support.

Delisting will be considered when:

1. Three viable, self-sustaining populations of at least 240 individuals (adults and subadults) each have been established and subsequently maintained for a minimum of twelve years.

2. Sufficient habitat quality, quantity, and spatial configuration to support these populations is retained / protected or secured for the long-term.

For delisting, exchange of individuals and gene flow among subpopulations must be natural (i.e., not manipulated or managed).

Interim Recovery Goal

Due to the challenging nature of attaining the recovery criteria, an interim recovery goal has been established to assist in determining progress towards the ultimate goals of reclassification and delisting.

This interim goal is to achieve and maintain a minimum of 80 individuals (adults and subadults) in each of two reintroduction areas within the historic range and to maintain, restore, and expand the south / south-central Florida subpopulation.

The interim goal will be met when:

1. The south / south-central Florida panther subpopulation has been maintained, restored, and expanded beyond 80 to 100 individuals (adults and subadults).

2. Two subpopulations with a minimum of 80 individuals each have been established and maintained within the historic range.

3. Sufficient habitat quality, quantity, and spatial configuration to support these three subpopulations is retained / protected or secured for the long-term.

There must be exchange of individuals and gene flow among these subpopulations. This exchange of individuals and gene flow can be either natural or through management.

Actions Needed

1. Maintain, restore, and expand the panther population and its habitat in south Florida.
2. Expand the breeding portion of the population in south Florida to areas north of the Caloosahatchee River.
3. Identify potential reintroduction areas within the historic range of the panther.
4. Reestablish viable panther populations outside of south and south-central Florida within the historic range.
5. Secure, maintain, and restore habitat in reintroduction areas.
6. Facilitate panther conservation and recovery through public awareness and education.

Total Estimated Cost of Recovery

Cost estimates reflect costs for specific actions needed to achieve Florida panther recovery. Estimates do not include costs that agencies or other entities normally incur as part of their mission or normal operating expenses. The following table provides cost estimates for five years for recovery actions listed in the Implementation Schedule of this document. These costs reflect an estimate of funding that could come from FWS and / or its many partners listed in the Implementation Schedule. Costs for some recovery actions were not determinable; therefore, the total cost for recovery during this period is higher than this estimate.

Estimated Cost of Recovery for Five Years by Recovery Action Priority (Dollars x 1,000):

Year	Priority 1 Action	Priority 2 Actions	Priority 3 Actions	Total
1	875	1,981	1,713.5	4,569.5
2	875	1,696	1,506.5	4,077.5
3	835	1,561	1,231.5	3,627.5
4	835	921	981.5	2,737.5
5	835	921	981.5	2,737.5
Total	4,255	7,080	6,414.5	17,750

Date of Recovery

If all actions are fully funded and implemented as outlined, including full cooperation of all partners needed to achieve recovery, criteria for reclassification from endangered to threatened could be accomplished within 30 years; criteria for delisting could be accomplished within 45 years following reclassification. However, due to the challenging nature of panther recovery these are estimates that will be reevaluated as recovery actions are implemented.

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I. BACKGROUND

The Florida panther (*Puma concolor coryi*) was listed as endangered throughout its range in 1967 (32 FR 4001) and received Federal protection under the passage of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (ESA). Because it is listed pursuant to the ESA, the panther and its habitat are protected by the ESA.

The ESA establishes policies and procedures for identifying, listing, and protecting species of plants, fish, and wildlife that are endangered or threatened with extinction. The purposes of the ESA are "to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, [and] to provide a program for the conservation of such endangered species and threatened species…." The ESA defines an "endangered species" as "any species which is in danger of extinction throughout all or a significant portion of its range." A "threatened species" is defined as any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." Under the definition of "species" in the ESA, the U.S. Fish and Wildlife Service (FWS) can apply the protections of the ESA to any species or subspecies of fish, wildlife, or plants, or any distinct population segment of any species of vertebrate fish or wildlife that meets the definition of endangered or threatened.

The Secretary of the Department of the Interior is responsible for administering the ESA's provisions as they apply to the Florida panther. Day-to-day management authority for endangered and threatened species under the Department's jurisdiction has been delegated to the U.S. Fish and Wildlife Service (FWS). To help identify and guide species recovery needs, section 4(f) of the ESA directs the Secretary to develop and implement recovery plans for listed species. Such plans are to include: (1) a description of site-specific management actions necessary to conserve the species; (2) objective, measurable criteria which, when met, will allow the species or populations to be removed from the endangered and threatened species list; and (3) estimates of the time and funding required to achieve the plan's goals and intermediate steps. Section 4 of the ESA and regulations (50 CFR Part 424) promulgated to implement its listing provisions also set forth the procedures for reclassifying and delisting species on the Federal lists. A species can be delisted if the Secretary of the Interior determines that the species no longer meets the endangered or threatened status based upon the five factors listed in section 4(a)(1) of the ESA: (1) the present or threatened destruction, modification, or curtailment of its habitat or range; (2) overutilization for commercial, recreational, scientific, or educational purposes; (3) disease or predation; (4) the inadequacy of existing regulatory mechanisms; and (5) other natural or manmade factors affecting its continued existence.

Further, a species may be delisted, according to 50 CFR Part 424.11(d), if the best scientific and commercial data available substantiate that the species or population is neither endangered nor threatened for one of the following reasons: (1) extinction, (2) recovery, or (3) original data for classification of the species were in error.

The FWS has lead responsibility for recovery of the Florida panther, and all Federal agencies including FWS are responsible for contributing to panther conservation pursuant to section 7(a)(1) of the ESA. In 1981, FWS issued the initial recovery plan, and the plan was revisited in the mid-1980s culminating in the first major revision in 1987. A minor revision to incorporate a task to address genetic restoration and management was approved in 1995. In 1999, the FWS approved the South Florida Multi-species Recovery Plan (MSRP) (FWS 1999) that identified recovery needs of 68 threatened and endangered species in south Florida. The MSRP included recovery actions for the panther, but only for the portion of its range in south Florida. The FWS acknowledges that portions of the MSRP are now outdated and the habitat descriptions need to be clarified to more accurately describe panther habitat.

In 2001, the FWS initiated the process to revise the overall recovery plan for a third time. A new Florida Panther Recovery Team, consisting of representatives of the public, agencies, and groups that have an interest in panther recovery and / or could be affected by proposed actions, was established to assist with this revision.

Since approval of the original recovery plan in 1981 (FWS 1981), significant research has been conducted and important conservation and recovery activities have been accomplished primarily by the Florida Game and Freshwater Fish Commission (now the Florida Fish and Wildlife Conservation Commission [FWC]). This third revision of the recovery plan reflects many of those accomplishments, addresses current threats and needs, addresses the planning requirements of the ESA, and supersedes previous recovery plans including the Florida panther component of the MSRP.

A. Overview

The Florida panther, is the last subspecies of *Puma* (also known as mountain lion, cougar, puma, painter, or catamount) still surviving in the eastern U.S (throughout this document the Florida panther will be referred to as "panther" and "puma" will be used for all other subspecies). Historically occurring throughout the southeastern U.S., today the remaining 100 - 120 panthers are restricted to less than 5% of their historic range (Figure 1). The breeding component of this population is located on approximately 3,548 square miles (mi^2) (9,189 square kilometers [km^2]) (Kautz et al. 2006) south of the Caloosahatchee River in southern Florida. The population density ranges from approximately 2.0 to 2.8 animals per 100 mi^2 (0.8 to 1.1 per 100 km^2) (Maehr et al. 1991a; Kautz et al. 2006; R. McBride, Livestock Protection Company, pers. comm. 2006)

Attempts to eradicate panthers in the past and prey decline resulted in a population threatened with extinction. Prior to 1949, panthers could be killed in Florida at any time of the year. In 1950, FWC declared 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 FWS listed the panther as endangered (32 FR 4001) throughout its historic range. The Florida Panther Act (State Statute 372.671), a 1978 Florida State law, made killing a panther a felony. The States of Florida, Georgia, Louisiana, and Mississippi list the Florida panther as endangered.

FWS uses recovery priority numbers, ranging from a high of 1C to a low of 18, to assign recovery priorities to listed species. The criteria on which the recovery priority number is based are degree of threat, recovery potential, taxonomic distinctiveness, and presence of an actual or imminent conflict between the species and development activities. The FWS has assigned the panther a recovery priority number of 6C. This priority number identifies the panther as a subspecies with a high degree of threat of extinction, but low recovery potential because recovery is in conflict with construction, other development projects, or other forms of economic activity (48 FR 43098).

Habitat loss and fragmentation continue to threaten the panther's existence. Survival and recovery of the Florida panther are dependent upon maintaining, restoring, and expanding the panther population and its habitat in south Florida and facilitating panther conservation and recovery through public awareness and education. In addition, recovery requires expanding the breeding portion of the population into south-central Florida (Figure 2), identifying potential reintroduction areas within the historic range, and establishing and maintaining at least two additional viable populations with associated habitats outside of south and south-central Florida.

B. 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). Adult males can reach a length of seven feet (ft) (2.1 meters [m]) from their nose to the tip of their tail and may exceed 161 pounds (lbs) (73 kilograms [kg]) in weight; but, typically adult males average around 116 lbs (52.6 kg) and stand approximately 24 - 28 inches (in) (60 - 70 centimeters [cm]) at the shoulder (Roelke 1990). Female panthers are smaller with an average weight of 75 lbs (34 kg) and length of 6 ft (1.8 m) (Roelke 1990). The skull of the Florida panther is unique in that it has a broad, flat, frontal region, and broad, high-arched or upward-expanded nasal bones (Young and Goldman 1946).

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 six months old. At this age, their bright blue eyes slowly turn to the light-brown straw color of the adult (Belden 1988).

Three external characters—a right angle crook at the terminal end of the tail, a whorl of hair or cowlick in the middle of the back, and irregular, white flecking on the head, nape, and shoulders—not found in combination in other subspecies of *Puma* (Belden 1986), were commonly observed in Florida panthers through the mid-1990s. The kinked tail and cowlicks were considered manifestations of inbreeding (Seal 1994a), whereas the white flecking was thought to be a result of scarring from tick bites (Maehr 1992, Wilkins et al. 1997). Four other abnormalities prevalent in the panther population prior to the mid-1990s included cryptorchidism (one or two undescended testicles), low sperm quality, atrial septal defects (the opening between two atria fails to close normally during fetal development), and immune deficiencies and were also suspected to be the result of low genetic variability (Roelke et al. 1993a).

A plan for genetic restoration and management of the Florida panther was developed in September 1994 (Seal 1994a) and eight non-pregnant adult female Texas pumas (*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 (Land et al. 2004). In addition, to date neither atrial septal defects nor cryptorchidism have been found in introgressed panthers (M. Cunningham, FWC, pers. comm. 2005). The effects of genetic restoration on color and cranial and dental measures have not been evaluated.

C. Taxonomy

Since the first classification of felids by Linnaeus (1758), there have been a number of reclassifications. A brief review of cat species classification history is presented by Werdelin (1996) and shows a record of extremes in both "splitting" and "lumping" (Nowell and Jackson (1996). The most recent evaluation of the felid family is Wozencraft's (1993) classification (Werdelin 1996). A considerable amount of work is still required before consensus can be reached regarding felid systematics and the consensus must involve both morphological and molecular work (Werdelin 1996). A consensus molecular, morphological, and ethological classification scheme would provide a framework for conservation programs and will become increasingly important as wild populations become smaller and increasingly isolated (O'Brien 1996a).

Although there is general agreement among felid taxonomists regarding recognition of cat species, there is considerable confusion with regards to subspecies, debate on subspecies definition, and debate on whether or not the traditional taxonomic concept is valid in the light of contemporary knowledge of population biology and genetics (Nowell and Jackson 1996). There is general agreement that too many subspecies of cats have been described in the past on the basis of slim evidence (Nowell and Jackson 1996). Mayr (1940, 1963, 1970) defined a subspecies as "a geographically defined aggregate of local populations which differ taxonomically from other subdivisions of the species" (cited in O'Brien 1996b). O'Brien and Mayr (1991) and O'Brien (1996b) provide criteria for subspecies classification. Following their criteria, a subspecies includes members that share a unique geographic range or habitat, a group of phylogenetically concordant phenotypic characters, and a unique natural history relative to other subdivisions of the species.

The Florida panther was first described by Charles B. Cory in 1896 as *Felis concolor floridana* (Cory 1896). The type specimen was collected in Sebastian, Florida. Bangs (1899) believed that the Florida panther was restricted to peninsular Florida and could not intergrade with other *Felis* spp. Therefore, he assigned it full specific status and named it *Felis coryi* since *Felis floridana* had been used previously for the bobcat (*Lynx rufus*).

The taxonomic classification of the *Felis concolor* group was revised and described by Nelson and Goldman (1929) and Young and Goldman (1946). These authors differentiated 30 subspecies using geographic and morphometric (measurement of forms) criteria and reassigned the Florida panther to subspecific status as *Felis concolor coryi*. This designation also incorporated *F. arundivaga* which had been classified by Hollister (1911) from specimens collected in Louisiana into *F. c. coryi*.

The puma was originally named *Felis concolor* by Linneaus in 1771, but in 1834 Jardine renamed the genus *Puma* (Wozencraft 1993). Later taxonomists lumped most of the smaller cat species, including the puma, into subgenera under the genus *Felis* (Nowak and Paradiso 1983). Wozencraft (1993) promoted the subgenera of the old genus *Felis* to full generic status and placed a number of former *Felis* species, including the puma, in monotypic genera (Nowell and Jackson 1996). The taxonomic classification of the puma is now considered to be *Puma concolor* (Wozencraft 1993), making the accepted name for the Florida panther *P. c. coryi*.

A comprehensive molecular genetic analysis of pumas in southern Florida using mitochondrial DNA and nuclear markers reported by O'Brien et al. (1990) indicated the existence of two distinct genetic stocks with concordant morphological phenotypes. The close phylogenetic proximity of the southwest Florida population segment with representatives of other North American subspecies indicated this population segment was descended from historic *P. c. coryi*. The population segment in southeastern Florida, however, appeared to have evolved in South or Central America. This was accounted for by the release of seven captive animals (including three females) into Everglades National Park (ENP) between 1957 and 1967 (unpublished archives, ENP, National Park Service [NPS], Washington, D.C., cited in O'Brien et al. 1990). The subpopulation in ENP became effectively extirpated with the death of three resident females in June and July 1991 (Bass and Maehr 1991).

As people exterminated puma in eastern North America, the only population that remained was in peninsular Florida and they became isolated from other puma populations, eliminating gene flow. As the Florida panther was reduced to a small breeding population in southern Florida, the lack of gene flow and small population size fostered a high rate of inbreeding as seen in reduced allozyme variation relative to other puma subspecies (Roelke et al. 1993a) and eight fixed loci (Culver et al. 2000). The inbreeding condition and reduction of genetic diversity appeared to have occurred during the 20th century as Culver et al. (2000) found museum samples from the Florida population dating to the turn of the 19th century that had higher heterozygosity levels. The consequences of inbreeding included spermatozoal defects, cryptorchidism, cardiac abnormalities, and reduced immunity to infectious diseases (Roelke et al. 1993a).

Through the late 1980s and early 1990s, the frequency of individuals exhibiting physiological abnormalities increased. Approximately 90% of males born after 1990 had one or both testicles undescended (Pimm et al. 2006a). The FWS (1994a) became concerned that the overall genetic health of the Florida panther was at a point where the panther's continued existence was doubtful without a proactive genetic restoration program. A plan for genetic restoration and management was developed (Seal 1994a). The level of introgression required to reverse the effects of inbreeding and genetic loss required the release of eight Texas puma into areas occupied by Florida panther (Seal 1994a). These eight female Texas puma were released in 1995, five of which produced a total of 20 offspring (Land et al. 2004). The desired 20% introgression level was achieved (Land and Lacy 2000) and the genetic rescue of the Florida panther was determined to be successful (Pimm et al. 2006a). Three times as many introgressed kittens appear to reach adulthood as do uncrossed Florida panthers and introgressed adult females have lower mortality rates (Pimm et al. 2006a).

Subspecies can interbreed as a natural process whenever they are in contact (O'Brien and Mayr 1991) and this was the basis for choosing Texas pumas (the closest extant adjacent subspecies) for genetic restoration of the Florida panther (FWS 1994a). Prior to making the decision to conduct genetic augmentation to facilitate the recovery of the Florida panther, FWS made the determination that any resulting offspring would receive the full protections of the ESA. This determination was the result of a rigorous policy and legal review at the highest levels of the agency (FWS 1994b).

Culver et al. (2000) speculated that the moderate level of genetic variability found in North American puma was due to their extirpation during Pleistocene glaciations and then recolonization some 10,000 years ago. Modern puma eventually covered practically the entire North American continent (excluding the most northern latitudes) and had the largest range of any native mammal species in the Western Hemisphere (Hall and Kelson 1959). Within this extensive range, geographic variation was present and involved subtle differences in body measurements, pelage characteristics, and skeletal features. When puma subspecies were first described, it was this geographic variation that was used to delineate each subspecies. Characters previously used to describe *P. c. coryi* were quantified and re-evaluated using statistical methods by Wilkins et al. (1997). All historic and recent specimens from the southeastern U.S. (n = 79) were examined for pelage color, cranial profile and proportions, and other morphological traits. These specimens were compared to a sample of North and South American specimens. The characters measured provide a basis from which to describe the Florida population and discriminate between it and other populations (Wilkins et al. 1997).

Recent molecular genetic analyses have found that pumas in North America are very similar to each other (Culver et al. 2000, Sinclair et al. 2001, Anderson et al. 2004). Culver et al. (2000) examined subspecies of puma by using three mitochondrial genes and ten microsatellite loci in biological samples collected from 315 pumas from throughout their range. They could not confirm the previous classification of 32 subspecies and, based on the subspecific criteria suggested by O'Brien and Mayr (1991), could only recognize six subspecies of *Puma*. Culver et al. (2000) suggested all North American pumas be reclassified as a single subspecies (*P. c. couguar*) due to lack of genetic structure. However, Culver et al. (2000) determined that the

Florida panther was one of several smaller populations that had unique features, the number of polymorphic microsatellite loci and amount of variation were lower, and it was highly inbred (eight fixed loci).

The degree to which the scientific community has accepted the use of genetics in puma taxonomy is not resolved at this time. The existing Florida panther population represents the last remaining population of *Puma* in the eastern United States, and is therefore important to the genetic representation of pumas in North America. Additional research is needed to understand genetic and morphological similarities and differences of puma across North America. The Florida panther is listed under the ESA and any change in its listing status based on best available science would require completing the formal rulemaking process pursuant to the ESA. The panther and its habitat continue to receive ESA protections.

D. Population Trends and Distribution

The Florida panther once ranged throughout the southeastern U.S. from Arkansas and Louisiana eastward across Mississippi, Alabama, Georgia, Florida, and parts of South Carolina and Tennessee (Young and Goldman 1946) (Figure 1). 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). Survey reports and more than 70,000 locations of radio-collared panthers recorded between 1981 and 2004 clearly define the panther's current breeding range (Figure 1). Reproduction is known only in the Big Cypress Swamp / Everglades physiographic region in Collier, Lee, Hendry, Miami-Dade, and Monroe Counties south of the Caloosahatchee River (Belden et al. 1991). Although confirmed panther sign, male radio-collared panthers, and uncollared males killed by vehicles have been recorded outside of south Florida, no female panthers have 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 2006).

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% of transient puma, and 57% of kittens could be detected by track searches in Utah. During two month-long investigations – one late in 1972 / 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 (R. McBride, pers. comm. 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 two additional panthers in the Fakahatchee Strand and suggested that there could be as few as ten panthers in the area around Lake Okeechobee and southward in the state (Nowak and McBride 1975). This initial survey documented that panthers still existed in Florida and delineated areas where a more exhaustive search was warranted. After this initial investigation, comprehensive surveys on both public and private lands were completed (Reeves 1978; Belden and McBride 1983a, b; Belden et al. 1991). Thirty panthers were identified during a wide-ranging survey in 1985 in south Florida (McBride 1985).

Maehr et al. (1991a) provides the only published estimate of population density based on a substantial body of field data (Beier et al. 2003). Maehr et al. (1991a) estimated a density of 1 panther / 43 mi^2 (110 (km^2) based on 17 concurrently radiocollared and four uncollared panthers. They extrapolated this density to the area occupied (1,946 mi^2 [5,040 km^2]) by radio-collared panthers during the period 1985 - 1990 to achieve a population estimate of 46 adult panthers for southwest Florida (excluding ENP, eastern Big Cypress National Preserve [BCNP], 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.

McBride (2000, 2001, 2002, 2003) documented panther counts (i.e., number known alive) based on panthers treed with hounds, physical evidence (e.g., tracks where radio-collared panthers were not known to occur), documentation by trail-camera photos, and sightings of uncollared panthers by a biologist or pilot from a monitoring plane or via ground telemetry. He counted 62, 78, 80, and 87 panthers (which include adult and subadult panthers but not kittens at the den) in 2000, 2001, 2002, and 2003, respectively. The number of documented panthers was 78, 82, and 97 in 2004, 2005, and 2006 (R. McBride, pers. comm. 2007).

McBride (pers. comm. 2007) documented an increase in the number of uncollared panthers captured each year between 2000 and 2006 relative to 1981 through 1999, while FWC (2006) reported data showing an apparent increase in the number of panthers killed by vehicles and number of known den sites since 1999. These data, along with an increase in the number of male panthers dispersing north of the Caloosahatchee River (Belden and McBride 2006), indicate an increasing trend in the panther population.

Although the breeding segment of the panther population occurs in south Florida, panthers were documented north of the Caloosahatchee River over 125 times between February 1972 and May 2004. This has been confirmed through field sign (e.g., tracks, scrapes, scats), camera-trap photographs, seven highway mortalities, four radio-collared animals, two captured animals (one of which was radiocollared), and one skeleton. From 1972 through 2004, panthers have been confirmed in 11 counties (Flagler, Glades, Highlands, Hillsborough, Indian River, Okeechobee, Orange, Osceola, Polk, Sarasota, Volusia) north of the river (Belden et al. 1991, Belden and McBride 2006). However, no evidence of a female or reproduction has been documented north of the Caloosahatchee River in over 30 years (Belden and McBride 2006).

E. Life History / Ecology

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 three years based on 26 radio-collared panthers of both sexes (Maehr et al. 1991a). Based on genetics work, some males may become breeders as early as 17 months (W. Johnson, National Cancer Institute, pers. comm. 2005). Breeding activity peaks from December to March (Shindle et al. 2003). Litters (n = 82) are produced throughout the year, with 56 - 60% 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. 1989a) and successful reproduction has occurred up to 11 years old. 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 (see Captive Breeding section of F. Conservation Efforts) successfully produced another litter an average of 10.4 months after the removal of the initial litter (Land 1994).

Den sites are usually located in dense, understory vegetation, typically saw palmetto (*Serenoa repens*) (Maehr 1990a, Shindle et al. 2003). Den sites are used for up to two months by female panthers and their litters from birth to weaning. 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--Intraspecific aggression accounts for 42% of all mortalities among radio-collared panthers (Jansen et al. 2005, Lotz et al. 2005). Unknown causes and collisions with vehicles account for 24 and 19% of mortalities, respectively. From 1990 to 2004, mean annual survivorship of radio-collared adult panthers was greater for females (0.894 ± 0.099 sd) than males (0.779 ± 0.125 sd) (Lotz et al. 2005). Most intraspecific aggression occurs between male panthers; but, aggressive encounters between males and females, resulting in the death of the female, have occurred. Defense of kittens and / or a kill is suspected in half (5 of 10) of the known instances through 2003 (Shindle et al. 2003).

Female panthers are considered adult residents if they are older than 18 months, have established home ranges, and bred (Maehr et al. 1991a). Land et al. (2004) reported that all 24 female panthers radiocollared when still dependent juveniles greater than six months of age survived to become residents and 19 (79.2%) produced litters. Male panthers are considered adult residents if they are older than three years and have established a home range that overlaps with females. Thirty-one male panthers were captured as kittens and 12 (38.7%) of these cats survived to become residents (Jansen et al. 2005, Lotz et al. 2005). "Successful male recruitment appears to depend on the death or home-range shift of a resident adult male" (Maehr et al. 1991a). Turnover in the breeding population is low with documented mortality in radio-collared panthers being greatest in subadults and non-resident males (Maehr et al. 1991a, Shindle et al. 2003).

One hundred thirty-two female panther den sites have been documented since 1985 (FWC 2006). For 38 of these litters, Land et al. (2004) estimated Florida and introgressed panther kitten survival to six months to be 52 and 72%, respectively. Pimm et al. (2006a, 2006b) reported a better than twofold advantage for introgressed kitten survival (P = 0.01). Survival of kittens greater than six months old was determined by following the fates of 55 radio-collared dependent-aged kittens, including 17 introgressed panthers from 1985 - 2004. Only one of these 55 kittens died before reaching independence, resulting in a 98.2% survival rate (Land et al. 2004). The FWC and NPS are continuing to compile and analyze existing reproductive and kitten data.

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] vs. 12.6 mi [20.3 km], respectively) and the maximum dispersal distance recorded for a young male Florida panther was 139.2 mi (224.1 km) over a seven-month period followed by a secondary dispersal of 145 mi (233 km) (Maehr et al. 2002a). Male Florida panthers disperse an average distance of 25 mi (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% 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 for females (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 1997a).

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 2006). 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, State Route (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 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 2006).

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 26 radio-collared panthers monitored between 1985 and 1990 averaged 200 mi^2 (519 km^2) for resident adult males and 75 mi^2 (193 km^2) for resident adult females; transient males had a home range of 240 mi^2 (623 km^2) (Maehr et al. 1991a). 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 251 mi^2 (650 km^2) and females had a mean home range of 153 mi^2 (396 km^2). Beier et al. (2003) found home range size estimates for panthers reported by Maehr et al. (1991a) 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 24 - 459 mi^2 (63 - 1,188 km^2), averaging 140 mi^2 (362 km^2) for 20 resident adult males and 69 mi^2 (179 km^2) for 32 resident adult females (Land et al. 1999; Shindle et al. 2000, 2001; Land et al. 2002). 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 (D. Jansen, NPS, pers. comm. 2005). Home-range overlap is extensive among resident females and limited among resident males (Maehr et al. 1991a).

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 that 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 1997a, 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 1997a). Panthers are capable of moving large distances in short periods of time. Nightly panther movements of 12 mi (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. 1991a). 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. 1991a, 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 are white-tailed deer (*Odocoileus virginianus*) 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 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 - 11 days; this frequency is 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.

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 had been negative since testing began in 1978. However, between November 2002 and February 2003, two panthers tested FeLV antigen positive (Cunningham 2005). The following year, three more cases were diagnosed. 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 - 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 that panthers can be exposed and overcome the infection (Cunningham 2005). Management of the disease includes vaccination as well as removal of infected panthers to captivity for quarantine and supportive care. As of June 1, 2005, approximately one-third of the population had received at least one vaccination against FeLV (FWC and NPS, unpublished data). No new positive cases have been diagnosed since July 2004.

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 radiocollared but not vaccinated against the disease.

Feline immunodeficiency virus (FIV) is a retrovirus of felids that is endemic in the panther population. Approximately 28% of 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%) 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. 1993b) 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 (WNV). 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 WNV), 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 highly prevalent in the panther population. Hookworm infections in domestic kittens can cause significant morbidity and mortality resulting from blood loss. Hookworm infection in one panther kitten taken into captivity was believed to have resulted in anemia and poor body condition; improvement in hematological parameters and condition followed anthelmintic treatment (Dunbar et al. 1994). The impact of this parasite on panther kittens in the wild is unknown.

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). 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 concentrations of 150 parts per million (ppm) mercury in its hair (Land et al. 2004). Elevated levels of p, p'– DDE (a breakdown product of DDT, an organochlorine pesticide) and polychlorinated biphenyls 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 cause of death was undetermined 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 and did not survive to leave their natal den. Although other factors were believed to have been responsible for the kitten mortalities, 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 BCNP warrant continued monitoring (Land et al. 2004). Other environmental contaminants found in panthers include polychlorinated biphenyls (e.g., Aroclor 1260) (Dunbar 1995, Land et al. 2004).

F. Habitat Characteristics / Ecosystem

Landscape Composition--Noss and Cooperrider (1994) considered the landscape implications of maintaining viable panther populations. Assuming a male home range size of 215 mi^2 (558 km^2) (Maehr 1990a), 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 – 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 - 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 - 2,000 adult panthers [Ballou et al. 1989]), could require as much as 156,251 - 234,376 mi^2 (404,687 - 607,031 km^2). This latter acreage corresponds to roughly 60 - 70% of the Florida panther's 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).

The FWS created the Multi-species/Ecosystem Recovery Implementation Team (MERIT) to assist with implementation of the MSRP after it was signed in 1999. The Florida Panther Subteam of MERIT developed a landscape-level strategy for the conservation of the panther population in south Florida, which was not finalized. Many of the Panther Subteam members refined the methodology, further analyzed the data, and better defined the results of this landscape-level strategy (Kautz et al. 2006). Data from radio-collared panthers collected from 1981 through 2000 were used to delineate home ranges, which were geo-referenced with land cover and other relevant data.

Compositional analysis was performed to evaluate the relative frequency of occurrence of various land cover types within panther habitat. A spatially-explicit raster model that identified forest patches potentially suitable for use by panthers as cover was used to refine the outer boundaries of the occupied zone, represented as overlapping minimum convex polygons of panther home ranges, and as a first step to identifying zones of potential use elsewhere. Cover components were combined with a least cost path analysis to delineate a dispersal zone connecting occupied habitat in southern Florida to the Caloosahatchee River.

Three priority zones were identified as important for panther habitat conservation: (1) Primary Zone – lands essential to the long-term viability and persistence of the panther in the wild; (2) Secondary Zone - lands contiguous with the Primary Zone, currently used by few panthers, but which 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 3). The Primary Zone is currently occupied and supports the breeding population of panthers. Although panthers move through the Secondary and Dispersal Zones, they are not currently occupied by resident panthers. Some areas of the Secondary Zone would require restoration to support panthers.

These zones vary in size, ownership, and land cover composition. The Primary Zone is 3,548 mi^2 (9,189 km^2) in size, 73% of which is publicly owned, and includes portions of the BCNP, ENP, Fakahatchee Strand Preserve State Park (FSPSP), FPNWR, Okaloacoochee Slough State Forest (OSSF), and Picayune Strand State Forest (PSSF). This zone’s composition is 45%

forest, 41% freshwater marsh, 7.6% agriculture lands, 2.6% prairie and shrub lands, and 0.52% urban lands (Kautz et al. 2006).

The Secondary Zone is 1,269 mi^2 (3,287 km^2) in size, 38% of which is public land. This zone's composition is 43% freshwater marsh, 36% agriculture, 11% forest, 6.1% prairie and shrub lands, and 2.3% low-density residential areas and open urban lands (Kautz et al. 2006).

The Dispersal Zone is 44 mi^2 (113 km^2) in size, all of which is privately owned. This zone's composition is 49% agriculture (primarily improved pasture and citrus groves), 29% forest (wetland and upland), 8.8% prairie and shrub land, 7.5% freshwater marsh, and 5.1% barren and urban lands (Kautz et al. 2006).

Habitat Use--Between 1981 and 2007, more than 80,000 locations on more than 148 VHF radio-collared panthers have been collected. The majority of data from VHF radio-collars have been collected during daytime hours (generally 0700 - 1100) for logistical and safety reasons, even though panthers are most active during crepuscular and night time hours. However, recent developments in Global Positioning System (GPS) radio-collar technology is beginning to provide a more thorough analysis of panther habitat use (Land et al. in press).

Radio-collar data and ground tracking indicate that panthers use the mosaic of habitats available to them. Forested cover types, particularly cypress swamp, pinelands, hardwood swamp, and upland hardwood forests are the habitat types most selected by panthers (Belden 1986, Belden et al. 1988, Maehr 1990a, Maehr et al. 1991a, Maehr 1992, Smith and Bass 1994, Kerkhoff et al.

2000, Comiskey et al. 2002, Cox et al. 2006). Compositional analyses by Kautz et al. (2006) showed that forest patches comprise an important component of panther habitat in south Florida, and that other natural and disturbed cover types are also present. 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. in press).

Kautz et al. (2006) found that the smallest class of forest patches (i.e., 9 - 26 ac [3.6 - 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 1990a). Shindle et al. (2003) found that 73% of panther dens were in palmetto thickets.

Prey Habitat Use--Panther habitat selection is related to prey availability (Janis and Clark 1999, Dees et al. 2001) and, consequently, prey habitat use. Duever et al. (1986) calculated a deer population of 1,760 in BCNP, based on Harlow's (1959) deer density estimates of 1 / 210 ac (85 ha) in pine forest, 1 / 299 ac (121 ha) in swamps, 1 / 1,280 ac (518 ha) in prairie, 1 / 250 ac (101 ha) in marshes, and 1 / 111 ac (45 ha) in hammocks. Schortemeyer et al. (1991) estimated deer densities at 1 / 49 - 247 ac (20 - 100 ha) in three management units of BCNP based on track counts and aerial surveys. Labisky et al. (1995) reported 1 / 49 ac (20 ha) in southeastern BCNP. Using track counts alone, McCown (1994) estimated 1 / 183 - 225 ac (74 - 91 ha) on the FPNWR and 1 / 133 - 200 ac (54 - 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 1990a, Maehr et al. 1991a, 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. Open marshes, dry-prairie/grasslands, and other vegetation types can also support high deer densities. However, the importance of these habitat types to panthers is dependent upon the availability of stalking and ambush cover.

Travel and Dispersal Corridors--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 - 10.9 mi (9.8 - 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% of the average home range size of an adult. For Florida panthers, this would translate to a corridor width of 5.5 mi (8.8 km). Without supporting empirical evidence, Noss (1992) suggests that regional corridors connecting larger hubs of habitat should be at least 1.0 mi (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 mi (0.8 km) should be more than 328 ft (100 m) wide, and corridors extending 0.6 - 4 mi (1 - 7 km) should be more than 1,312 ft (400 m) wide. The Dispersal Zone encompasses 44 mi^2 (113 km^2) with a mean width of 3.4 mi (5.4 km). Although it is not adequate to support even one 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. Within south-central Florida, corridors have been identified to connect potential panther habitat patches (Thatcher et al. 2006a).

G. Habitat and Prey Management

Land management agencies in south Florida are implementing fire programs that attempt to mimic a natural fire regime through the suppression of human-caused wildfires and the application of prescribed natural fires. 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. However, winter fires may increase the probability of endangering neonates (Land 1994).

Eight public land areas within the Primary Zone are managed by five Federal or State agencies and one non-governmental organization (NGO). The annual prescribed fire goals of these public land areas total 166 mi^2 (430 km^2). Two-to-five year fire rotations and burn compartments less than 10 mi^2 (25 km^2) are recommended to increase habitat heterogeneity (Schortemeyer et al. 1991). However, fire prescriptions vary based on fuel conditions, weather conditions, and historic fire frequency. Compartment size will vary based on site conditions, including the use of existing fire breaks or reluctance to establish new fire breaks that would reduce native habitats, fragment native habitats, and serve as vectors for the spread of invasive plants. For example, FPNWR, the only area managed specifically for panthers, uses existing swamp buggy trails and highways as burn compartment boundaries. FPNWR is divided into 54 burn compartments that range in size from 0.47 – 1.72 mi^2 (1.22 – 4.45 km^2). A range of 8 - 12 mi^2 (20 - 32 km^2) is burned annually depending on weather conditions. The fire program at BCNP averages 47 - 62 mi^2 (121 - 162 km^2) burned annually (4 - 5% of the total area) as many habitats are adapted to long fire intervals.

Chemical, biological, and mechanical control of invasive plants is also conducted to maintain and restore native habitat types. Invasive non-native vegetation has the capacity to replace native plant communities and drastically change the landscape both visually and ecologically. The invasive plants of most concern in south Florida are melaleuca (*Melaleuca quinquenervia*), Brazilian pepper (*Schinus terebinthifolius*), old-world climbing fern (*Lygodium microphyllum*), cogongrass (*Imperata cylindrica*), and downy rose-myrtle (*Rhodomytrus tomentosus*). The effect of invasive plants on panther habitat utilization is unknown. However these species may reduce the panther's prey base by disrupting natural processes such as water flow and fire and by significantly reducing available forage. All public lands in south Florida have active invasive plant treatment programs. As of 2002, over 243 mi^2 (630 km^2) of invasive plants had been treated, with an estimated 579 mi^2 (1,500 km^2) yet untreated. No studies have been conducted to determine the effects of invasive plant management on panthers.

Management for panther prey consists of a variety of approaches such as habitat management and regulation of hunting and off-road vehicle (ORV) use. Prey management has been accomplished by regulating harvest using a variety of strategies. ENP, FSPSP, and FPNWR are closed to hunting. Corkscrew Regional Ecosystem Watershed, PSSF, OSSF, and BCNP allow hunting. Only BCNP allows ORV use by hunters. It also has the longest deer and hog hunting season (95 days), whereas the other three areas allow hunting for 35 days or less annually. A combination of hunter and vehicle use quotas, restrictions on hunting methods, and harvest limits are used in BCNP to regulate impacts on the panthers' prey base. Over the past 25 years, the annual deer and hog harvest reported at check stations has averaged 210 and 127, respectively, representing a sample of deer and hogs actually harvested. Hunter pressure during that time period has averaged 15,809 "hunter-days" annually (Adams and Bozzo 2002).

H. Response to Management Activities

Few studies have examined the response of panthers to various land / 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). 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 (1990a) reported that indirect human disturbance of panthers may include activities associated with hunting and that panther use of Bear Island (part of BCNP) is significantly less during the hunting season. Schortemeyer et al. (1991) examined the effects of deer hunting on panthers at

BCNP 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 (BCNP) 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. 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, indicative of a reaction to human disturbance. Whereas the reaction to trails was probably minor and could be related to prey behavior, decreased use of Bear Island most likely reflects a direct reaction to human activity and resulted in increased use of adjacent private lands.

I. Reasons for Listing / Threats Assessment

The Florida panther was listed as endangered throughout its range in 1967 (32 FR 4001), pursuant to the Endangered Species Preservation Act, and received Federal protection under the passage of the ESA in 1973. The 1967 document did not address the five factor threats analysis. However, we address these factors in the summary below.

Threats Assessment--A detailed threats assessment for the panther was conducted by the Florida Panther Recovery Team using The Nature Conservancy's (TNC) planning approach (TNC 2000) (Appendix B). Using this approach, the stresses (the types of degradation and impairment) for each factor were identified and evaluated in terms of severity and scope; sources of stresses were evaluated in terms of contribution and irreversibility. Separate analyses were conducted for the panther population in south Florida and for reintroduction in the Southeast.

Factor A: The present or threatened destruction, modification, or curtailment of its habitat or range--The panther's current occupied range is significantly reduced from its historic range from Louisiana and Arkansas east to South Carolina and southward through Florida. The breeding portion of the panther population occurs only in south Florida, less than 5% of its historic range (Figure 1). Because of their wide-ranging movements and extensive spatial requirements, panthers are sensitive to habitat fragmentation (Harris 1984).

Land Use Changes in Southeastern States--Based on the current trends of urbanization across the Southeast, it is likely that forested habitats will continue to be permanently altered, and the amount of available forest habitat will decrease in some areas (Wear and Greis 2002). Compared to earlier periods, land use in the Southeast has been fairly stable since 1945, with the most notable exception of Florida, where developed land uses have expanded substantially (Wear and Greis 2002). Two dominant forces strongly influenced recent land use changes: (1) urbanization driven by population and general economic growth and (2) changing economic returns from agriculture relative to timber production; both of these influences are expected to continue (Wear and Greis 2002). As a result of anticipated population and economic growth, rural land will be converted to urban uses. Forecasts of land uses indicate that the Southeast could experience a net loss of from 12,500 - 18,750 mi^2 (32,375 - 48,562 km^2) of forest land (roughly 5 - 8%) between 1992 and 2020 (Wear and Greis 2002).

Potential panther habitat throughout the Southeast continues to be affected by urbanization, residential development, conversion to agriculture, mining and mineral exploration, lack of land use planning, and other sources of stress (Appendix B). With human population growth and increased human disturbance, the extent of potentially suitable habitat remaining in the Southeast is expected to decrease. Habitat loss, fragmentation, degradation, and disturbance from human activity throughout the Southeast are expected to remain among the greatest threats to reintroduced panther populations. As development pressure and population growth continue, the opportunity for panther reintroduction in the Southeast diminishes.

Land Use Changes in Florida--Habitat loss, fragmentation, and degradation, and associated human disturbance are the greatest threats to panther survival and among the greatest threats to its recovery. These threats are expected to continue in Florida and throughout the Southeast. Throughout Florida, between 1936 and 1987, cropland and rangeland increased 6,609 mi^2 (17,118 km^2) or 30%, urban areas increased by 6,172 mi^2 (15,985 km^2) or 538%, while herbaceous wetlands declined by 6,063 mi^2 (15,702 km^2) or 56% and forests declined by 6,719 mi^2 (17,402 km^2) or 21% (Kautz et al. 1993, Kautz 1994). Assuming that all of the forest lost was panther habitat, Kautz (1994) estimated that the 21% loss of forests was the equivalent of 35 - 70 male panther home ranges and 100 - 200 female panther home ranges. Between 1985 – 1989 and 2003 an additional 5,019 mi^2 (13,000 km^2) (13%) of natural and semi-natural lands (including panther habitat) in the state were converted to urban / developed and agricultural uses (Kautz et al. 2007).

Continued expansion of urban areas on the coasts and the spread of agricultural and urban development in the interior of Florida continue to replace, degrade, and fragment panther habitat, placing the panther at greater risk. Over 83% of the 2,500 mi^2 (6,475 km^2) of agricultural land in southwest Florida has been categorized as rangeland. In southwest Florida between 1986 and 1990, row crop acreage increased by 14 mi^2 (36 km^2) or 21%; sugarcane increased by 25 mi^2 (65 km^2) or 21%; citrus increased by 84 mi^2 (219 km^2) or 75%; and rangeland, much of it suitable for panther occupation, decreased by 250 mi^2 (647 km^2) or 10% (Townsend 1991). Rangeland losses were about evenly divided between agricultural and urban development (Townsend 1991).

The extent of land use conversions for southwest Florida (Collier, Lee, Hendry, Charlotte, and Glades Counties) between 1986 and 1996 was estimated using a change detection analysis performed by Beth Stys (FWC, unpublished data). The area of disturbed lands increased 31% in these five counties between 1986 and 1996, with the greatest increases in disturbed lands occurring in Hendry and Glades Counties. Most (66%) of the land use change over the 10-year period was due to conversion to agricultural uses. Forest cover types accounted for 42% of land use conversions, dry prairies accounted for 37%, freshwater marsh accounted for 9%, and shrub and brush lands accounted for 8%. Randy Kautz (FWC, pers. comm. 2003) estimated panther habitat loss to be 0.8% per year between 1986 and 1996 using a composite of three different methodologies. These included: (1) review of U.S. Forest Service forest data between 1936 and 1995 using loss of forest as an index of the rate of panther habitat loss, (2) analysis to detect changes in land cover in five south Florida counties (Charlotte, Collier, Glades, Hendry, Lee) between 1986 and 1996 using classified Landsat imagery, and (3) using the Cox et al. (1994) panther habitat model, and based on 1986 Landsat data, 1996 Landsat landcover data was overlaid and then areas originally mapped as panther habitat and subsequently converted to other uses over the 10-year period were tabulated. Randy Kautz (Breedlove, Dennis, and Associates, pers. comm. 2005) believes the estimated annual habitat loss since 1996 may be 2 to 3 times higher than that calculated for the previous period.

More recently, Stys calculated the extent of semi-natural and natural lands that have been converted to agricultural and urban / developed in Florida between 1985 - 1989 and 2003 (B. Stys, FWC, pers. comm. 2005). Based upon this analysis, approximately 570 mi^2 (1,476 km^2) of natural and semi-natural lands in Glades, Hendry, Lee, Collier, Broward, Monroe, and Miami-Dade Counties were converted during this time period (FWC, unpublished data). Of these, approximately 340 mi^2 (880 km^2) were conversions to agricultural uses and 230 mi^2 (596 km^2) to urban uses.

Rapid development in southwest Florida has compromised the ability of landscapes to support a self-sustaining panther population (Maehr 1990b, 1992). Maehr (1990b) reported that there were approximately 3,401 mi^2 (8,810 km^2) of occupied panther range in south Florida and that approximately 50% is comprised of landscapes under private ownership. In 2005, Kautz found that approximately 22% of the land in the Primary Zone, 60% of the land in the Secondary Zone, and 100% of the land in the Dispersal Zone is in private ownership (R. Kautz, pers. comm. 2005). Maehr (1990b) indicated that development of private lands may limit panther habitat to landscapes under public stewardship. Given the panther's reliance on public land, the rising cost of land is an impediment to habitat protection and therefore panther recovery.

Highways in wildlife habitat are known to result in loss and fragmentation of habitat, traffic related mortality, and avoidance of associated human development. As a result, small populations may become isolated, subjecting them to demographic and stochastic factors that reduce their chances for survival and recovery. Two-lane 108 ft (33 m) and four-lane 328 ft (100 m) cleared rights-of-way, respectively, occupy 2.0 and 6.2% of each 640 ac (259 ha) of land through which they pass (Ruediger 1998). Highways can also stimulate land development as far away as 2 mi (3.2 km) on either side (Wolf 1981). Thus, for each 1 mi (1.6 km) a highway is extended, 2,500 ac (1,012 ha) are potentially opened to new development (Wolf 1981).

Belden and Hagedorn (1993) observed that Texas pumas introduced into northern Florida established home ranges in an area with one-half the road density of the region in general, and tended to avoid crossing heavily traveled roads. Female Florida panthers rarely establish home ranges in areas bisected by highways (Maehr 1997b). Because home ranges of resident males typically encompass the ranges of multiple female panthers, males are less likely than females to find sufficiently large areas devoid of major roads. Males tend to cross highways more frequently than females and suffer more vehicle-related injuries and mortalities (see Factor E).

In addition to a direct loss and fragmentation of habitat, constructing new and expanding existing highways may increase traffic volume and impede panther movement within and between frequently used habitat blocks throughout the landscape (Swanson et al. 2005). Increases in traffic volume, increasing size of highways (lanes), and habitat alterations adjacent to key road segments may limit the panther's ability to cross highways and may ultimately isolate some areas of panther habitat (Swanson et al. 2005).

Past land use activity, hydrologic alterations, and lack of fire management (Dees et al. 1999) have also affected the quality and quantity of panther habitat. The effect of invasive plants on panther habitat utilization is unknown. As the remaining forested uplands are lost, sloughs containing cypress, marsh, and shrub wetlands comprise a greater percentage of the remaining habitat available relative to habitat historically available to panthers.

Human Population Growth--Insight can be gained into expected rates of habitat loss in the future by reviewing human population growth projections for the south Florida region. Smith and Nogle (2001) developed low, medium, and high population growth projections for all Florida counties from 2000 through 2030. Using their medium projections, which they believe provide the most accurate forecasts, Smith and Nogle (2001) estimate that the human population of the 10 counties in south Florida will increase from 6.09 to 9.52 million residents by 2030, an increase of 56%.

Human population in the southeastern U.S. has increased 10-fold since 1850, expanding from 4.7 million to over 48 million in 2000 (Swanson et al. 2005). In Florida, the population increased from 87,000 to over 17 million (Swanson et al. 2005, U.S. Census Bureau 2004). From 1990 - 2004, the population in Collier County increased from 152,099 to 296,678 (U.S. Census Bureau 2002, 2004). During the same time period, the population in Lee County increased from 335,113 to 514,295 (U.S. Census Bureau 2002, 2004). The population of southwest Florida, particularly Collier and Lee Counties, is projected to increase 21% by 2010 (Swanson et al. 2005).

Factor B: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes— There are no commercial or recreational uses of panthers. In rare cases where a panther is unable to survive in the wild, it may be captured and used for conservation education purposes. Panthers are routinely captured and monitored for scientific purposes. Risks are associated with capture and monitoring, but the overall threat to the panther is considered low (Appendix B). Capturing and radiocollaring panthers and handling neonate kittens at dens may result in unintentional take relative to three factors.

First, mortality or injury may result from the capture event because of capture-induced trauma or an adverse reaction to immobilizing chemicals. Routine capture activities include the use of trained hounds to pursue and tree panthers and the subsequent anesthetization with remotely-injected immobilizing drugs. These activities may result in hyperthermia, hypothermia, dog bite wounds, drowning, fractures, lacerations, seizures, head and spinal trauma, penetration of the abdomen or thorax with dart, vomiting, aspiration, pneumothorax, respiratory depression or arrest, shock, cardiac arrest, or complications associated with treatment of the above conditions. However, the incidence of these injuries, especially serious injuries and mortalities, has been low over the last 25 years of panther capture work in part because of stringent capture and handling protocols developed and implemented by FWC, NPS, and FWS. Since 1981, the FWC has captured and immobilized 133 panthers over 296 times with only one fatality, two panthers suffering broken legs that resulted in their temporary removal to captivity for rehabilitation and the successful return to the wild, and the holding of one other panther for 24 hours to treat an injury involving a needle embedded in bone (D. Land, FWC, pers. comm. 2004). NPS staff in BCNP have been capturing adult panthers and handling kittens at dens since 2003. Between 2003 and 2005, the NPS handled 19 adult or dependent juvenile panthers with no injury or mortality (Jansen et al. 2005).

Second, capture and handling events can result in abandonment of kittens, other disruptions of family structure, or injury to a kitten that requires its removal from the wild for rehabilitation. Further, the injury or death of an adult female with dependent-aged kittens (those less than 1 year of age) could result in the death of the kittens or the need to raise them in captivity. Neonate kittens are handled at den sites when the kittens are older than 2 weeks of age and when the mother is not present. These activities do not require anesthesia of the kittens. Handling activities could result in injury or death to the kitten or the abandonment of one or more of the kittens. From 1986 - 2004, the FWC has captured and radiocollared 59 dependent-aged kittens ranging in age from 4 - 18 months (D. Land, pers. comm. 2004). These captures resulted in the abandonment of two kittens. One was subsequently reared in captivity and released. The other died of an infection in captivity shortly after its capture. Early break-up of family groups may have occurred on a few other occasions. For this reason, dependent-aged kittens less than one year are no longer captured. Between 1992 and 2005, FWS and NPS handled 195 kittens at 82 dens with no injury, mortality, or den abandonment (Jansen et al. 2005, Lotz et al. 2005).

Third, the loss of contact with or access to young radio-collared panthers whose collars need to be resized to accommodate growth may result in the collar becoming embedded in the panther's neck. If the panther cannot be recaptured to remove (e.g., if a radiocollar prematurely fails) or resize the collar, infection and eventual death could occur. In September 2001, the FWC and NPS began fitting young panthers with break-away radiocollars. This change in protocol has greatly reduced the risks associated with radiocollaring young panthers (D. Land, pers. comm. 2004).

If stringent capture and handling protocols continue to be followed and refined, injury levels are expected to remain low and are not expected to significantly affect important demographic parameters at the population level, including mortality and reproductive rates or recruitment of juveniles. Handling panthers is important for research, management, and monitoring of the population, and overall the risks are low.

Factor C: Disease or Predation--The Florida panther is susceptible to a number of infectious diseases and parasites some of which are of population significance while others are important only to the individual. Some diseases have not been diagnosed in panthers but remain a potential threat. As a single contiguous population, there is potential for an infectious disease to have a catastrophic impact on the panther.

Although FeLV is common in domestic cats, it is quite rare in non-domestic felids. The recent outbreak of this disease in the panther population shows the potential of this disease to be of population significance. Another viral disease potentially of population significance is PRV. PRV causes respiratory and reproductive disorders in adult hogs and mortality in neonates, but is a rapidly fatal neurologic disease in carnivores. Approximately 35% of feral hogs are seropositive for PRV in Florida (van der Leek et al. 1993). The virus is actively shed by only a small percentage of infected hogs at any given time; however, stress can increase the percentage that shed the virus (Murphy et al. 1999). Feral hogs are an important prey species for panthers (Maehr et al. 1990b), and there is potential for significant mortality in panthers due to PRV.

Raccoons are a common prey item for panthers (Maehr et al. 1990b) and are the most important reservoir for rabies in the Southeast (Burridge et al. 1986). As panthers are now vaccinated against rabies at capture, only uncollared panthers are at significant risk.

PLV causes significant mortality in domestic kittens. The virus is also carried by raccoons and is quite stable in the environment. However, kittens are at greatest risk of infection and causes of mortality in this cohort are largely unknown. An epizootic of PLV caused significant mortality among radio-collared bobcats in the late 1970s in south-central Florida (Wassmer et al. 1988), suggesting that the panther population may also be at risk.

Hookworm infections in domestic kittens can cause significant morbidity and mortality resulting from blood loss. The impact of this parasite on panther kittens in the wild is unknown.

Some individual panthers have been shown to be at risk from exposure to mercury in the food chain (Newman et al. 2004). Mercury bioaccumulates through the aquatic food chain reaching high concentrations in higher trophic level carnivores such as raccoons and alligators. Panthers preying on these species are at risk for accumulating high tissue mercury concentrations. Neonates may be more susceptible to the toxic effects of mercury (Berglund and Berlin 1969).

Disease and parasites have not been documented to be a major mortality factor in the panther population (Maehr et al. 1991b, Taylor et al. 2002). However, this observation is largely based on the captured and vaccinated sample of the population. Disease expression and mortality events for the unmarked and unvaccinated segment of the population, including kittens, may be higher, especially for those diseases included in the vaccination regimen. Further, as the panther population density increases there is an increased risk of diseases transmitted by direct contact. The FeLV outbreak demonstrated the potential impact of infectious diseases on the population. Should a virulent pathogen enter the population, there is no absolute barrier in south Florida that could prevent such a disease from impacting the entire population (Beier et al. 2003). Consequently, until additional populations of panthers can be established elsewhere in their historic range, infectious diseases and parasites remain a threat. Finally, infectious diseases, parasites, and environmental contaminants, even of low pathogenicity, may work synergistically to reduce panther fitness and reproduction.

Factor D: The Inadequacy of Existing Regulatory Mechanisms--The panther is federally listed as endangered and is on the State endangered lists for Florida, Georgia, Louisiana, and Mississippi. The protection provided by Federal (ESA, Clean Water Act [62 Stat. 1155, as amended; 33 U.S.C. 1251-1376] [CWA], National Environmental Policy Act of 1969 [83 Stat. 852, as amended; 42 U.S.C. 4321-4347] [NEPA], Fish and Wildlife Coordination Act [48 Stat.

401, as amended; 16 U.S.C. 661 et seq.] [FWCA]) and State (Florida protective provisions specified in Rules 68A-27.0011 and 68A-27.003) laws help conserve the panther and its habitat.

Section 7(a)(2) of the ESA requires that all Federal agencies consult with FWS to ensure that any action authorized, funded, or carried out by the agency is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat. If a project will not jeopardize the continued existence of a species but may result in incidental take of the species, FWS works with the action agency and any applicants to find ways to minimize the effects of the take. Section 7(a)(1) requires all Federal agencies to utilize their authorities in furtherance of the ESA by carrying out programs for the conservation of listed species. Section 4(a)(3) requires the designation of critical habitat for listed species to the maximum extent prudent and determinable. Section 9 prohibits unlawful acts, including unauthorized take.

As discussed in Factor A, development pressure in southwest Florida has been high; for example, data for Collier, Lee, and Hendry Counties, a stronghold for the panther population, indicate that from 1985 through 2003 more than 223 mi^2 (578 km^2) of natural and semi-natural lands were converted to agriculture (FWC, unpublished data). In addition, more than 145 mi^2 (375 km^2) of semi-natural and natural lands in this three-county area have also been lost to development (FWC, unpublished data) (see Factor A). While not all of these habitat losses and conversions involved panther habitat, many projects involved wetland impacts, requiring permit review by the U.S. Army Corps of Engineers (COE) pursuant to section 404 of the CWA and / or coordination among regulatory agencies pursuant to the FWCA. For projects with a Federal nexus, consultation pursuant to section 7 of the ESA was needed for actions that may affect the panther. Through compensation for some of these projects, FWS helped secure conservation of 62 mi^2 (161 km^2) in the Primary, Secondary, and Dispersal Zones from September 2003 to June 2008.

Section 10(a)(1) allows for the issuance of permits for scientific or enhancement of survival purposes, provided that certain terms and conditions are met. Section 10(a)(2) allows for the issuance of permits, provided that the taking will be incidental to an otherwise lawful action, adequately minimized and mitigated, appropriately funded, and will not appreciably reduce the likelihood of survival and recovery of the species in the wild. Through 2007, no Habitat Conservation Plans (HCP) have been finalized under section 10(a)(2) of the ESA and no incidental take permits have been issued for the panther. Section 10, however, provides opportunities for large-scale and regional approaches to panther habitat conservation, and can be a valuable tool at the county or regional level.

Florida Statute 373.414 requires that activities permitted in wetlands and surface waters of the state are not contrary to the public interest. If it is determined that an activity will adversely affect panthers or panther habitat, the governing board (Water Management District [WMD]) or the Florida Department of Environmental Protection (FDEP) can consider measures (e.g., on-site mitigation, off-site mitigation, purchase of credits from mitigation banks) that will mitigate the effects of the regulated activity.

In addition to the impacts of individual projects, the FDEP and WMD shall take into account cumulative impacts on water resources (Section 373.414(8), F.S.). Cumulative impacts can be considered unacceptable when they provide unacceptable impacts to functions of wetlands, including the utilization of the wetlands by wildlife species (Sections 4.2.8 through 4.2.8.2 of the South Florida Water Management District Basis of Review). In practice, evaluating cumulative impacts of development in southwest Florida on panthers has not been sufficient to prevent significant loss of panther habitat. Since the majority of panther habitat in southwest Florida has significant wetland components, provisions of 373.414 are usually a part of the review of proposed development. The State wetlands permitting authorities can also assess whether a regulated activity will cause adverse secondary impacts to aquatic or wetland dependent species, such as panthers, including where the site does not have a wetland component (Section 4.2.7 of the South Florida Water Management District Basis of Review).

The FWC may exercise the regulatory and executive powers of the State with respect to wild animals, including panthers. The FWC has responsibility for conserving and managing these species and their habitat; however the FWC does not provide regulatory protection for listed species habitat. The FWC provides comments regarding potential impacts to panther habitat to FDEP and WMDs under the authority of Chapter 20.331 Florida Statutes.

Because of the project-specific focus of regulatory programs, statutorily set processing time frames, and other constraints such as high workloads, local, State, and Federal regulatory agencies sometimes find it difficult to complete the cross-government review that would be ideal to thoroughly review and effectively assess all potential impacts to panthers. In addition, local, State, and Federal agencies sometimes have difficulty monitoring permit compliance and tracking the precise impact on species and habitat from authorized actions, as well as tracking the impact from unauthorized actions. Assessing current baseline conditions and accurately predicting future impacts are also challenging because the panther is a wide-ranging species that uses a wide array of habitat types. Furthermore, baseline conditions for the panther are continually changing (e.g., impacts from development, conservation actions). Rigorous assessments and close coordination and scrutiny of project impacts by local, State, and Federal agencies during the planning phase could help maximize conservation benefits for the panther.

*Factor E: Other Natural or Manmade Factors Affecting its Continued Existence***--**

Mortality, Trauma, and Disturbance--Florida panthers were hunted for bounty during the 1800s and for sport until the 1950s. Nine illegal shootings were documented in south Florida between 1978 and 2005, three of which were not fatal. Education, self-policing among hunters, and regulation are the tools by which shootings are minimized. All free-ranging puma in Florida are treated as Endangered because they closely resemble the Florida panther and are therefore protected by a "similarity of appearance" provision pursuant to the ESA.

Records on documented mortality of uncollared panthers have been kept since February 13, 1972. Records on mortality of radio-collared panthers have been kept since February 10, 1981. Eighty-four radio-collared panthers have died since 1981, and intraspecific aggression was the leading cause, accounting for 42% of these mortalities (Lotz et al. 2005). Unknown causes and collisions with vehicles accounted for 24% and 19% of mortalities, respectively. Other factors (7%), infections (5%), and diseases (4%) caused the remaining mortalities (Land et al. 2004).

One-hundred fifty-three panther mortalities were documented from February 1972 through June 2004, with at least 58 (41%) of known deaths occurring in the last four-year period (Land et al. 2004). Overall, documented mortality (n = 105) of radiocollared and uncollared panthers averaged 3.4 per year through June 2001. However, from July 2001 through June 2004, documented mortality (n = 48) increased with an average of 16.0 per year (Land et al. 2004). This increase in panther mortality (e.g., intraspecific aggression, collisions with vehicles) corresponds with increases in the panther population observed in recent years.

From February 1972 through June 2004, 36 documented panther mortalities were the result of intraspecific aggression (Land et al. 2004). Although most of these encounters are male-male, from July 2001 through June 2004, at least nine females were killed in encounters with males (Land et al. 2004). Defense of kittens and / or a kill is suspected in five of these instances that occurred through 2003 (Shindle et al. 2003).

From February 1972 through June 2004, 27 documented panther mortalities were from unknown causes (Land et al. 2004). While a couple of deaths from unknown causes occur each year, five deaths occurred in various areas in 2000 and six deaths occurred in Seminole game and safari pens in 2003 (Land et al. 2004).

Eighty-six panther-vehicle collisions were documented between 1972 and 2005 of which 80 (52%) resulted in panther deaths (Lotz et al. 2005). Panther-vehicle collisions were identified as the third most important source of mortality among radiocollared panthers (19%) (Land et al. 2004). Fifty-six percent (48) of panther-vehicle collisions have occurred since 2000 with all but two being fatal to the panther (Lotz et al. 2005). Approximately 53% of documented panther-vehicle collisions have occurred within the Primary Zone through 2004 (Swanson et al. 2005). Panther-vehicle collisions are a significant source of mortality and pose an on-going threat. In addition, new and existing roads, expansion of highways, and increases in traffic volume and speed contribute to loss of panther habitat and impede movement within and between high use habitat blocks throughout the landscape (Swanson et al. 2005) (see Factor A). New and expanded highways could to increase the threat of panther mortality and injuries due to collisions if they are not accompanied by adequate fencing and crossings.

Wildlife crossings and continuous fencing were required during the conversion of two-lane SR 84 (Alligator Alley) into four-lane I-75. Until August 12, 2007, no panther mortalities had been documented in these protected areas since completion of I-75 in 1992. Similarly, six wildlife crossings and some fencing were required along SR 29 as a prerequisite to the SR 29 / I-75 interchange. All six of these crossings are now complete; however panther-vehicle collisions occur both where the fencing ends and when panthers enter the fenced area and become trapped. In addition, two crossings were required on County Road 858 (Oil Well Road) to offset projected traffic increases from development. In the absence of crossings and fencing, the remaining stretches of SR 29 and I-75 as well as several other roads continue to pose a serious mortality risk to panthers, including U.S. 41 (Tamiami Trail), SR 82, and County Roads 850 (Corkscrew Road), 858, 846 (Immokalee Road), 832, and 833. Through May 2007, 85 of 107 mortalities or injuries from panther-vehicle collisions occurred along these unsecured roads (Swanson et al. 2005, FWC unpublished data).

Florida's human population has been steadily growing and as a result, urban / suburban areas now interface with panther habitat. Extensive developments planned in Collier County, such as the Ave Maria University and associated town, will expand local road networks and extend the human / panther interface into primary panther habitat (Swanson et al. 2005).

In recent years, there has been an increase in human-panther interactions and hobby livestock depredations that have resulted in management responses. For example, in 2004, aversive conditioning was used on panthers observed near areas of human habitation in the Pinecrest area within BCNP, and a juvenile dependent male panther was subsequently relocated to OSSF. If human-panther interactions and livestock depredations increase, the potential for complaints from the public and, in some cases, the need for subsequent management responses could result in take of panthers in the form of harassment through aversive conditioning in an attempt to teach individuals to avoid humans. However, if the panther's location presents a possible threat to public safety (e.g., a dispersing male panther wanders into an urban neighborhood and can not find its way out) or there is a threat to the survival of the panther (e.g., a panther wanders into an area that contains numerous physical hazards), depending on specific circumstances, the panther may be captured and relocated, or removed to an approved captive facility. If a panther's behavior indicates a threat to human safety, it will be permanently removed from the wild. In extreme circumstances, euthanasia may be necessary. Currently, the FWS, FWC, and NPS are working on a document titled *Interagency Florida Panther Response Plan*. This plan will provide guidance on methods for minimizing the potential for human-panther interactions and help ensure consistency in use of potential management responses.

There is the potential for disturbance to panthers from recreational uses on public lands. Maehr (1990a) and Schortemeyer et al. (1991) reported that 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 on areas open and closed to hunting. Responses to hunting for variables most directly related to panther energy intake or expenditure were not detected (Janis and Clark 2002). However, panthers reduced their use of an area of concentrated human activity, and were found farther from ORV trails during the hunting season, indicative of a reaction to human disturbance (Janis and Clark 2002). Whereas the reaction to ORVs was probably minor and could indirectly be related to prey behavior, decreased panther use of high human activity areas and increased use of adjacent private lands most likely reflects a direct reaction. Additional habitat loss on those private lands could exacerbate the negative consequences of this pattern of use (Janis and Clark 2002).

Loss of Genetic Diversity--Natural genetic exchange with other panther populations ceased when the Florida panther became geographically isolated over a century ago (Seal 1994a). Isolation, habitat loss, reduced population size, and associated inbreeding resulted in loss of genetic variability and diminished health. Data on polymorphism and heterozygosity, along with records of multiple physiological abnormalities, suggest that the panther population has experienced inbreeding depression (Roelke et al. 1993a, Barone et al. 1994). Measured heterozygosity levels indicate that the Florida panther had lost about 60 - 90% of its genetic diversity (Culver et al. 2000). Genetic problems in the Florida panther included heart murmurs, a high rate of unilateral cryptorchidism, low testicular and semen volumes, diminished sperm motility, and a high percentage of morphologically abnormal sperm.

To address these threats, a genetic management program was implemented with the release of Texas pumas into south Florida in 1995 (see Conservation Efforts Section). The results of genetic restoration have been successful as indicated by an increasing population, signs of increased genetic health, recolonization of areas in BCNP and ENP recently unoccupied, and increased dispersal (McBride 2000, 2001, 2002; Maehr et al. 2002a). To date, neither atrial septal defects nor cryptorchidism have been found in introgressed panthers (M. Cunningham, pers. comm. 2005). Semen examination of two introgressed panthers indicated that sperm volume, motility, and count were higher than for an uncrossed Florida panther. A preliminary assessment of genetic restoration suggested that the desired 20% introgression level had been achieved, but the contributions were primarily from two of the released females (Land and Lacy 2000). Genetic introgression is also reducing the occurrence of kinked tails and cowlicks in intercross progeny (Land et al. 2004).

Human Dimension--Human intolerance has the potential to be a major challenge to panther recovery. Recently, human-panther interactions have been on the rise in southwest Florida along the interface of urban and wild lands. From December 2003 through June 2007 there was one area of repeated sightings (Pinecrest area within BCNP), two encounters (an unexpected direct meeting between a human and a panther in which the panther displayed a lack of wariness to humans and did not approach, or show signs of curiosity, but retreated), a threat (this was the result of repeated depredations and significant behavioral changes by one panther that was ultimately removed from the wild), and 16 depredations (domestic livestock or pets being attacked or killed by a panther).

Previous recovery plans have called for the establishment of additional populations within the historic range of the panther (FWS 1981, 1987, 1995). The FWC studied the possibility of establishing additional populations within the historic range (Belden and Hagedorn 1993, Belden and McCown 1996). Between 1988 and 1995, 26 Texas pumas were released near Okefenokee NWR and Osceola National Forest. Study animals, monitored by radiocollars at least three days per week, established large home ranges, killed large prey at expected frequencies, and generally adapted well to their new environment (Belden and McCown 1996). When these studies were terminated, the remaining panthers were captured and removed from the wild.

Experimental releases of Texas pumas indicated that habitat and prey availability in northern Florida and southern Georgia were sufficient to support a panther population (Belden and McCown 1996). However, although there appeared to be support for reintroduction among the general public in Florida, local landowners tended to oppose having panthers on their property. Political and social issues will be the most difficult aspect of panther reintroduction and must be addressed (Belden and Hagedorn 1993, Belden and McCown 1996).

Habitat assessment studies have been conducted to identify potential sites for reintroduction of the panther in the Southeast (Thatcher et al. 2006b). The purpose of these studies was to identify prospective sites for panther reintroduction within the historic range based on quantitative landscape assessments. Nine potential reintroduction sites of sufficient size to support a panther population were identified including: Ozark National Forest region, Ouachita National Forest region, southwest Arkansas, and Felsenthal NWR region in Arkansas; Kisatchie National Forest region in Louisiana; Homochitto National Forest region in Mississippi; southwest Alabama; Apalachicola National Forest region in Florida; and Okefenokee NWR region in Georgia (Thatcher et al. 2006b).

Sociopolitical obstacles to large carnivore reintroduction are often more daunting than biological ones (Clark et al. 2002). A lack of public support and tolerance could prevent the reintroduction of panthers anywhere outside of Florida. Public support is critical to reintroduction efforts and attainment of recovery goals.

Contaminants--Because the panther is a top carnivore, bioaccumulation of environmental contaminants remains a concern (Dunbar 1995, Newman et al. 2004), with the threat of mercury toxicity considered medium (see Appendix B). However, mercury in the Everglades ecosystem has decreased over the last several years (Frederick et al. 2002). Other environmental contaminants found in panthers include polychlorinated biphenyls (Aroclor 1260) and organochlorines (Dunbar 1995, Land et al. 2004). Continued monitoring for contaminants, especially mercury and organochlorines, in panthers, their prey, and sentinel species is warranted (see E. Life History / Ecology).

Prey availability--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. A resident adult male puma generally consumes one deer-sized prey every 8 - 11 days; this frequency is 14 - 17 days for a resident female; and 3.3 days for a female with three 13-month-old kittens (Ackerman et al. 1986).

Historically, hunting in the Big Cypress physiographic region has been a major traditional activity with many hunt camps throughout the region. With establishment of national and state parks, the numbers of hunt camps were decreased and additional hunting regulations that reduced hunting pressure on deer were implemented. Although deer densities are difficult to determine, the deer population appears to have steadily increased.

Using aerial surveys, Schemnitz (1974) estimated the deer population in the 3,438 mi^2 (8,903 km^2) area south of the Caloosahatchee River and Lake Okeechobee at 20,000 in 1972, and stated that the deer population had decreased in the Water Conservation Areas (WCA) due to deeper water levels and submersion of tree islands. Fleming et al. (1994) compared deer density estimates in WCA 2 and 3 in the 1950s with those from 1985 - 1988 and found a 67% reduction in the deer herd. They surmised that this reduction was due to habitat degradation from impoundment and associated water management. ENP and portions of the WCAs are within the Primary Zone. Smith and Bass (1994), however, stated that fire and water, which drive the Everglades system, appear to have little effect on the long-term dynamics of the ENP deer population.

Few studies have been done on the hog component of the panthers' prey base (e.g., Maehr et al 1989b). However, the mean checked hog harvest of 29 in BCNP for 2003 - 2005 has fallen well below the previous 22-year average of 144, probably due to a combination of factors, including high water events and predation by panthers (D. Jansen, pers. comm. 2005).

Although the exact status of prey in different portions of the panther's occupied range is not known at this time, assessment of overall panther health and their success in raising young indicate that the prey base is adequate to support the current panther population. Adequate prey elsewhere within the historic range would be needed to establish populations in other areas.

J. Past and Current Conservation Efforts

Habitat Conservation and Protection--Habitat protection has been identified as being one of the most important elements to achieving panther recovery. While substantial efforts have been made to secure a sufficient habitat base (Figure 4), 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 FWS, NPS, Seminole Tribe of Florida, Miccosukee Tribe of Indians of Florida, FWC, FDEP, Florida Division of Forestry (FDOF), WMDs, NGOs, counties, and private landowners.

Public Lands--Public lands in south Florida that benefit the panther are listed below and shown in Figure 4:

- In 1947, ENP was established with 2,356 mi^2 (6,102 km^2) and in 1989 was expanded with the addition of 163 mi^2 (421 km^2).
- In 1974, Congress approved the purchase and formation of BCNP, protecting 891 mi^2 (2,307 km^2); later 228 mi^2 (591 km^2) were added.

- In 1974, the State of Florida began acquiring land for the FSPSP, which encompasses over 125 mi^2 (324 km^2). Efforts are underway to acquire approximately 26 mi^2 (68 km^2).
- In 1985, acquisition of PSSF and Wildlife Management Area (WMA) began with the complex Golden Gate Estates subdivision buyouts and now comprises over 119 mi^2 (308 km^2). The Southern Golden Gate Estates buyout through State and Federal funds is complete. The South Belle Meade portion of Picayune Strand is about 90% purchased and although the State is no longer purchasing in South Belle Meade, Collier County's Transfer of Development Rights program is helping to secure the inholdings.
- In 1989, FWS' FPNWR was established and now protects 41 mi^2 (107 km^2).
- In 1989, the Corkscrew Regional Ecosystem Watershed Land and Water Trust, a public / private partnership, was established and to date has coordinated the purchase of 42 mi^2 (109 km^2).
- In 1996, the South Florida WMD, purchased the 50 mi^2 (130 km^2) OSSF.
- In 2002 Spirit of the Wild WMA, consisting of over 11 mi^2 (28 km^2), was taken into public ownership by the State of Florida and is managed by FDOF.
- In 2003, Dinner Island Ranch WMA consisting of 34 mi^2 (88 km^2) in southern Hendry County was taken into public ownership by the State of Florida and is managed by FWC.

Tribal Lands--Lands of the Seminole Tribe of Florida and Miccosukee Tribe of Indians of Florida encompass over 547 mi^2 (1,416 km^2) in south Florida. Of these, 181 mi^2 (469 km^2) are used by panthers, and comprise 5% of the Primary Zone (R. Kautz, pers. comm. 2005). These lands are not specifically managed for the panther and are largely in cultivation.

Private Lands--A variety of Federal, State, and private incentives programs are available to assist private landowners and other individuals to protect and manage wildlife habitat. Voluntary agreements, estate planning, conservation easements, land exchanges, and mitigation banks are methods that hold untapped potential for conserving private lands. In 1954, the National Audubon Society established the nearly 17 mi^2 (45 km^2) Corkscrew Swamp Sanctuary. However, little additional private land has been protected south of the Caloosahatchee River for panther conservation. A number of properties identified by the State Acquisition and Restoration Council (ARC) for purchase by the Florida Forever Program are used by panthers (e.g., Devil's Garden, Half Circle F Ranch, Pal Mal, Panther Glades). North of the Caloosahatchee River, Fisheating Creek Conservation Easement, 65 mi^2 (168 km^2) in Glades County is a private holding used by panthers.

Habitat Protection Plans--

The Florida Panther Habitat Preservation Plan, South Florida Population--Released in 1993 by the Florida Panther Interagency Committee (Logan et al. 1993) and drafted to guide habitat acquisition, this document contains useful baseline information about lands that constitute important panther habitat.

FWS MSRP--Released by the FWS in 1999, the panther portion of the MSRP outlines how south Florida contributes to the rangewide recovery objective, but does not replace the approved 1995 recovery plan for the panther. While it provides a comprehensive, general overview of panther biology in south Florida, parts that have become outdated will be replaced by this recovery plan.

<u>*Florida Panther Subteam*</u>-- The FWS created MERIT to assist with implementation of the MSRP after it was signed in 1999. In 2000, the FWS formed the Florida Panther Subteam of MERIT to develop a landscape level conservation strategy for the panther in south Florida that could be applied in the planning and regulatory context. The Subteam produced a draft report, "Landscape Conservation Strategy for the Florida Panther in South Florida" (Landscape Conservation Strategy) in December 2002. The document includes a panther habitat map of Primary, Secondary, and Dispersal Zones, and outlines recommendations for protection of these areas. Some portions of the science and findings in the Landscape Conservation Strategy have been challenged. As of 2005, the FWS no longer distributes the document as a result of a Data Quality Act (Section 515 of Public Law 106-554) challenge. Many of the Panther Subteam members refined the methodology, further analyzed the data, better defined, and published the results of the Landscape Conservation Strategy (Kautz et al. 2006).

Regulatory Tools--

<u>*COE Panther Key*</u>--In 2000, FWS issued to the COE its final interim Standard Local Operating Procedures for Endangered Species (SLOPES) for conducting consultations between the FWS and the COE for permit applications that may affect panthers. The COE and FWS also co-developed a number of conservation measures that may, where appropriate and on a case-by-case basis, be incorporated into project designs to facilitate compliance with the requirements of the ESA. The COE and FWS revised the key in 2007. The COE and FWS plan to revise the SLOPES and other related documentation as needed and appropriate to incorporate new science developed in the future to conserve the panther.

FWS Panther Habitat Methodology--In 2002, FWS developed a draft Panther Habitat Assessment methodology to help guide the agency in evaluating permit applications for projects that could affect panthers and their habitat. This draft methodology was a way to assess the level of impacts to panthers expected from a given project, and to evaluate the effect of any proposed compensation offered by the project applicant. The draft methodology evolved over time to incorporate new information, and will continue to evolve in the future as new information is attained. FWS did not finalize an assessment methodology document but instead describes the methodology used to evaluate each project in detail in biological opinions. The habitat framework serves one important role in broader conservation efforts to maintain a panther population, and is complemented by activities such as fee-title acquisition, easements, and other local, State, and Federal conservation tools. The benefits from each of these conservation tools can be enhanced through coordination. For example, local, State, and Federal land conservation programs could identify and protect areas adjacent to parcels preserved through regulatory review, thereby increasing the size of connected, high-quality habitat for the panther.

Federal and State Project Planning--Under section 7(a)(2) of the ESA, FWS consults with Federal agencies proposing actions that may affect the panther. In addition, FWC provides comments regarding potential impacts to panther habitat to FDEP and WMDs under the authority of Chapter 20.331 Florida Statutes. Many of the impacts from development have been compensated through habitat protection in recent years. Using the evolving panther habitat methodology described above, FWS helped secure 62 mi^2 (161 km^2) in the Primary, Secondary, and Dispersal Zones from September 2003 to June 2008. In addition to habitat conservation, regulatory review allows other important compensation strategies to be considered and implemented. For example, new roads can be configured to direct traffic away from panther habitat. In addition, to help offset impacts from increases in traffic within panther habitat, project sponsors can construct crossings that allow panthers to pass safely from one side of a road to another, thereby minimizing the likelihood of vehicular collisions. New advances in science such as FWC's report entitled "Use of Least Cost Pathways to Identify Key Highway Segments for Panther Conservation" (Swanson et al. 2005) help identify optimal locations for crossings by depicting where vehicular collisions have occurred in the past. This allows agencies to set priorities and guide project sponsors to offset their impacts by providing crossings in areas with a history of problems.

FWS Panther Conservation Banks--FWS has initiated a conservation banking program in south Florida to address the impact of habitat loss on the Florida panther. Banks are expected to play a role in filling gaps in the current conservation lands network. By selecting optimum sites among willing participants the banking program provides opportunities to maintain traditional land uses, such as ranching, that are compatible with panther conservation while realizing value from protecting lands from future development.

When a development project has an adverse impact to panther habitat, compensation can be put forward to offset this impact. For small projects, land acquisition and restoration is typically difficult to accomplish, and not economically feasible. In addition, small pieces of compensation tend to fragment the conservation landscape making it of less value to the panther. Conservation banks are assigned a number of credits based on the location in the landscape and the habitat value to the panther. This bank of credit can be drawn upon by projects impacting panther habitat through payment to the banker. There is cost certainty in the banking credit value that allows potential development projects to evaluate the cost before making expensive development decisions while directing the compensation toward the best available lands for the panther. By protecting the land in perpetuity and restoring ecological function where feasible, the banks allow consolidation of numerous small impacts into more unified and connected conservation lands that provide to best ecological value to the panther.

Advisory Councils and Committees--

Florida Panther Technical Advisory Council--Chapter 38-172, Laws of Florida, established the Florida Panther Technical Advisory Council in 1983. The Council members represent State and Federal agencies and private and professional resource organizations. The Council serves in an advisory capacity to FWC on technical matters of relevance to the panther program, provides a forum for technical review and discussion of the status and development of the panther program, and provides a communications liaison between the technical agencies and organizations represented on the Council.

Florida Panther Interagency Committee (FPIC)--FWS, FWC, NPS, and FDEP established FPIC in May 1986. The FPIC was comprised of the Executive Directors of FWC and FDEP and the Regional Directors of FWS and NPS. The purpose of FPIC was to provide guidance and coordination on panther research and management activities. A Technical Subcommittee, composed of mid-level administrators, was appointed by FPIC to provide proposals and other information to be acted upon. FPIC and the Technical Subcommittee are no longer active.

Transportation Planning and Improvements--

Regional, Landscape Level Transportation Plans--Recent least-cost pathways analyses (e.g., Swanson et al. 2005) that identify highway segments crossed by panthers have compiled information that can be used to help avoid and reduce injury and mortality to panthers from collisions with vehicles.

The Florida Department of Transportation (FDOT) is developing a method of early proposal review through the Efficient Transportation Decision Making (ETDM) process that can help assure landscape level protection is addressed, maintain habitat and population connectivity, and protect wildlife and human safety. The State's Strategic Intermodal System Plan and Florida Transportation Plan 2025 focus on mobility and economic development yet include strengthened habitat and wildlife protection provisions. Federal, State, and local agency coordination, as well as public involvement, is needed in regional transportation planning so that expansions, extensions, or new roads; mass transit; and ports minimize fragmentation and degradation of panther habitat.

Reducing Vehicle Mortality--

Wildlife Crossings, Underpasses--FDOT's installation of underpasses and accompanying fencing in 1993 along the section of I-75 (Alligator Alley) successfully eliminated panther-vehicle collisions in that area. Incidents of panther-vehicle collisions have also been minimized in four additional areas where crossings and fencing have been installed on SR 29 (two north and two south of I-75). FDOT completed two additional underpasses along SR 29 in 2007.

Wildlife crossings increase initial road costs and require permanent conservation designation of the lands on both sides of the structure. However, the burgeoning human population with accompanying increases in personal and commercial vehicles necessitates many more road improvements to reduce the number of panther-vehicle collisions, as well as to help achieve greater human safety.

Reduced Speed Limits--Reduced nighttime speed zones have been in effect along many roads since July 1985 to minimize the likelihood of panther-vehicle collisions, however, compliance is a continuing problem. In addition, panther-vehicle collisions have occurred despite drivers following the legal speed limit. An evaluation of the effectiveness of these zones in reducing such collisions could help determine if further adjustments to the speed limits are warranted.

Research, Monitoring, and Management--

Research and Monitoring--The FWC began research on the panther with the development of a Florida Panther Record Clearinghouse in 1976. This was the first step in identifying whether or not this species existed in Florida and where it occurred. A total of 4,620 observations were reported to the Clearinghouse, but only 91 of these were confirmed to be a panther (Belden et al. 1991). The majority of the confirmations came from Collier, Hendry, and Miami-Dade Counties.

Capture and radio-collaring work by FWC began in 1981 and by NPS in 2001. Monitoring of radio-collared panthers has been done by NPS in ENP and BCNP since 1986 and 1988, respectively. The objectives of research and monitoring have been directed toward understanding the basic biology and habitat needs of the species. This research included movements, home range size and habitat use, morphological descriptions, food habits, mortality causes, and reproduction. Panther prey studies, including population dynamics, deer herd health and reproduction, and deer mortality have also been accomplished.

Concurrent with these studies, genetics work was being conducted by Dr. Stephen O'Brien of the National Cancer Institute, and collaborations with the Conservation Breeding Specialists Group were begun. Consultations with these experts on small population dynamics and inbreeding depression yielded a strategy to manage the panther population via genetic restoration. A genetic restoration plan was written in 1994 (Seal 1994a) and implemented in 1995 with the goal of improving the genetic health of the panther population. From 1995 through 2003, most panther capture and monitoring activities were directed towards evaluating genetic restoration. In addition, the goals of the BCNP research and monitoring work include determining the area's potential to support panthers, evaluating the effects of restoration projects and management strategies on the panther population within BCNP, and the extent of connectivity with the panthers in ENP.

Capture, handling, and biomedical sample collection by FWC and NPS follow established protocols to ensure safety and thoroughness. Radio-collared panthers are typically monitored by fixed-wing aircraft three times per week to determine location, habitat use, movements, interactions, births, and deaths. Several types of GPS collars are being field-tested by both FWC and NPS in order to obtain data on nocturnal movements and habitat use by panthers (Land et al. in press).

Since 1990, Florida panther research by FWC has been funded through the Florida Panther Research and Management Trust Fund, which receives its monies from the purchase of Florida panther specialty license plates. Through 2004, nearly 1.4 million panther license plates have been issued, generating nearly $40 million. Eighty-five percent of the proceeds from the extra $25.00 per license plate collected annually go into this trust fund. To obtain the money, FWC must submit a budget request each year to the Florida Legislature for approval. The NPS in ENP and BCNP supports its panther work within its annual budgets or special funding requests.

Captive Breeding--In 1984, John Lukas, Director of Conservation and Curator of Gilman Paper Company's White Oak Plantation, expressed an interest in breeding Florida panthers in captivity. At the time, a male Florida panther was convalescing at the FWC Wildlife Research Laboratory from injuries sustained when he was hit by a vehicle. These events led to the formalization of a plan to captive-breed panthers with the eventual goal of reestablishing them in unoccupied portions of their historic range.

In May 1985, FWC and Gilman Paper Company signed an agreement to breed panthers in captivity and to make suitable animals available for reintroduction. The captive-breeding facilities were constructed at White Oak in 1985 and 1986. The convalescing male panther was the first animal moved to these facilities. Three wild-caught female Texas pumas were brought to Florida in 1986 to be used as surrogates for Florida panthers.

The Florida Panther Viability Analysis and Species Survival Plan Workshop held in 1989 further defined the need to establish a captive Florida panther population as security against extinction and for the long-term preservation of the remaining gene pool (Seal and Lacy 1989). Establishment of a captive population with minimal impacts on the wild population and maximum genetic representation included the removal of selected kittens and adults from the wild over a three- to six-year period, not to exceed six kittens and two adults per year. The goal was to achieve a total panther population of 500 breeding adults (combination of all wild and captive populations) to retain 90% of the current genetic diversity for 100 years or longer (Seal and Lacy 1989).

After an extensive environmental review process, FWS determined that removal of these animals from the wild was not a major Federal action significantly affecting the quality of the human environment as defined under provisions of NEPA. However, The Fund for Animals, Inc., and Holly Jensen filed a lawsuit against FWS requesting a court injunction to prevent issuance of the subpermits needed to capture and remove panthers from the wild. An out-of-court settlement reached on February 6, 1991, identified a number of specific elements to be addressed in a Supplemental Environmental Assessment (EA). These elements were to explore and evaluate a genetic enrichment (augmentation) alternative; compare environmental, legal, and regulatory impacts of the proposed action and the genetic enrichment (augmentation) alternative; provide a thorough, expanded analysis on the issue of the feasibility and impact of reintroduction of captive-bred Florida panthers to the wild; and provide a thorough, expanded analysis of the impacts posed to the remaining wild population from the removal of Florida panthers (Jordan 1991).

Once the Supplemental EA had been developed and subpermits issued, six Florida panther kittens were brought into captivity in the spring of 1991 for use in the captive breeding program. Four additional kittens were removed from the wild in 1992. Two of these were taken to Lowry Park Zoological Garden in Tampa and two to Jacksonville Zoological Gardens. The plan was to pair these panthers for maintaining maximum genetic variability and viability when they matured. However, kitten removal from the wild ceased in 1992. The genetic health of the Florida panther population had deteriorated to a point where continued survival was questionable, even with selective breeding within a captive population, and plans were being formulated for genetic restoration by simulating natural gene flow by introducing animals from western puma populations (Seal 1994b). Therefore, captive breeding was not initiated and the captive animals were maintained for conservation education.

Genetic Restoration--A plan for genetic restoration and management of the panther was developed in September 1994 (Seal 1994a). The level of introgression required to reverse the effects of inbreeding and genetic loss required the release of eight female Texas pumas into areas occupied by Florida panthers (Seal 1994a). These eight female Texas pumas were released in 1995, five of which produced a total of 20 offspring (Land et al. 2004). None of the original eight Texas pumas remain in the population today (Land et al. 2004). A preliminary assessment of genetic restoration suggested that the desired 20% introgression level had been achieved, but the contributions were primarily from two of the released females (Land and Lacy 2000). The genetic restoration program appears to have been successful as determined by increased kitten and adult female survival, an increasing population, and an expansion in occupied range (Pimm et al. 2006a).

Reestablishment of panther populations in the southeastern U.S.--

Reintroduction Feasibility Studies in North Florida--FWC conducted two studies, from 1988 - 1989 (Belden and Hagedorn 1993) and from 1993 - 1995 (Belden and McCown 1996), to evaluate feasibility of reintroducing panthers into unoccupied areas of their historic range. The studies also identified the need to address social issues surrounding reintroduction.

In 1988, seven pumas captured in west Texas were released in north Florida as surrogates for evaluating the feasibility of translocating Florida panthers. The pumas included three adult males, three adult females, and one yearling female. They were monitored from 1988 - 1989. The pumas established overlapping home ranges, killed large prey at predicted frequencies, and settled into routine movement and feeding patterns before the hunting season. Three pumas died during the study, the cause of death was unknown for one found floating in the Suwannee River, and shooting was suspected or documented for the other two deaths. Results indicated methods for reducing puma-human interactions, such as placing release pens as far as possible from humans and livestock, which occurred most frequently during the immediate post-release period and during subsequent excursions from home ranges (Belden and Hagedorn 1993). Belden and Hagedorn (1993) recommended additional research on the feasibility of panther translocation with a larger initial stocking rate of 10 - 20 pumas to ensure that a social structure can be established if some of the animals do not survive.

In 1993, 19 pumas were released into north Florida, including 11 females and eight vasectomized males. Six of the pumas were born and raised in captivity, 10 were captured in the wild in western Texas and translocated to Florida, and three were captured in the wild in western Texas and held in captivity in Florida for two to eight years prior to release. The study concluded that reintroduction is biologically feasible, that is, pumas can successfully establish territories and sustain themselves when reintroduced. This study showed that home ranges for females in north Florida were approximately half the size of home ranges for female panthers in south Florida, likely due to more productive habitat in north Florida and southern Georgia (Belden and McCown 1996). The Belden and McCown (1996) study also highlights the need for an effective and comprehensive public education and outreach program that occurs well ahead of releasing panthers into reintroduction sites.

Habitat Assessment to Identify Potential Reintroduction Sites in the Southeastern U.S.--Jordan (1994) evaluated 24 sites in the southeastern U.S. based on biological and anthropogenic criteria and concluded that 14 sites should be evaluated further as potential panther reintroduction sites. These were assessed and ranked based on four criteria (area size, forest area, human population density, road density). Jordan (1994) indicated that additional analyses would be needed.

Thatcher et al. (2006b) identified and ranked nine potential reintroduction sites based on models that utilized three landscape and four human-influence variables on the landscape. These variables included 1) percentage of natural land cover, 2) spatial aggregation of natural land-cover patches, 3) habitat patch density, 4) human population density, 5) minor road density, 6) major road density, and 7) percentage of urban land cover. Thatcher et al. (2006b) recommended that the top three sites identified should be considered for further evaluation as potential reintroduction sites. They recommend field surveys of local habitat conditions (e.g., assessment of localized prey densities and the availability of understory vegetation or varied topography for stalking and denning cover) and evaluation of sociopolitical information such as public attitudes towards carnivore reintroduction in the chosen reintroduction sites.

Education and Outreach--

Panther Net Website--A multidisciplinary interactive website (www.panther.state.fl.us) was launched and funded by FWC in 1999 with proceeds of the Florida panther license plate. The site includes information for adults and school children on the natural history of the panther, its habitat, threats to its survival, research, management, and conservation efforts.

Northeast Florida Panther Education Program (Cramer 1995)--From September 1994 to November 1995 during the Florida Panther Reintroduction Feasibility Study, FWC sponsored this program that reached approximately 1,000 northeast Florida residents through a pamphlet, slide presentations, a county fair display, and a telephone survey. Results revealed a large base of support (75%) for reintroduction of panthers into the Osceola National Forest region. Results also identified specific community concerns, and made suggestions for addressing these through education and outreach. The results from the program can be applied to develop an effective communications program to address community concerns well in advance of subsequent reintroduction efforts.

Statewide Survey (Duda and Young 1995)--FWC sponsored a 1995 statewide attitudinal survey about Florida panthers. The survey revealed that 83% of Floridians surveyed support panther reintroduction efforts.

Public Workshops and Acceptability of Florida Panther Reintroduction--Three years after the 1993 - 1995 Florida Panther Reintroduction Feasibility Study ended, FWC sponsored a series of workshops in 1998 to address *Public Acceptability of Florida Panther Reintroduction* (Taylor and Pederson 1998). The study focused on residents in Columbia County because of their experience with earlier reintroduction feasibility studies. The goal was to engage residents in an exploration of concerns and possible ways to address them. However, while the working group was intended to represent a variety of interests, it consisted mostly of local opposition to reintroduction and consensus was not reached. The results demonstrated the need to engage a wider variety of interests in the process.

Recent Panther Outreach Initiatives--A variety of panther outreach initiatives have been undertaken in recent years to assist residents in southwest Florida learn to live safely and responsibly with the Florida panther and other wildlife. FWS coordinates a panther outreach team that collaborates to produce informational materials and hold outreach events about living and recreating safely in panther habitat. FWS, NPS, and FWC have led “Living with Panther” town hall meetings in communities experiencing human-panther interactions. Many members of the outreach team participated in the construction of predator-proof enclosures for livestock and pets to demonstrate proper husbandry for domestic animals while avoiding attracting predators. In recent years, a number of celebrations, field trips, educational talks, and other events have been held each March in southwest Florida to coincide with Save the Florida Panther Day (Florida Statute 683.18 designates the third Saturday of March of each year as "Save the Florida Panther Day."

Conservation Organizations--A number of conservation organizations are working to conserve and recover the panther through education, outreach, and advocacy. These include Defenders of Wildlife (www.defenders.org, www.biodiversitypartners.org), Florida Panther Society (www.panthersociety.org), Friends of the FPNWR (www.floridapanther.org), National Wildlife Federation (www.nwf.org), its state affiliate the Florida Wildlife Federation (www.fwfonline.org), and The Nature Conservancy (www.natureconservancy.org). Programs encompass public education and awareness initiatives, habitat conservation, transportation and land-use planning, compensation for livestock depredation, landowner incentive initiatives, and projects aimed at fostering human-panther coexistence.

Interagency Florida Panther Response Plan--FWC, FWS, and NPS established a Florida Panther Interagency Response Team in June 2004 to manage human-panther interactions while promoting human safety and assuring the continued existence and recovery of the panther. This team, comprised of panther experts and agency representatives, was tasked with developing a panther response plan to provide guidance for the agencies so that human / panther interactions would be dealt with consistently and quickly while addressing the primary objective of public safety and balancing the needs of recovering an endangered species. Additionally, the plan needed to address public education and outreach concerning panther interactions. The draft plan is being finalized.

Scientific Reviews--

Analysis of Scientific Literature Related to the Florida Panther and Panther Habitat--In 2002, FWC and FWS commissioned an independent Scientific Review Team (SRT) to complete an analysis of scientific literature related to the panther. Completed in 2003, the SRT report (Beier et al. 2003) found that a quarter-century of research strongly supported many published conclusions, including that forests are important as daytime rest sites of panthers, that white-tailed deer and feral hogs are the most important panther prey, that the most important threats to panther persistence include limited habitat area and continued habitat loss and fragmentation, and that recovery of the panther depends most critically on establishing additional populations outside of south Florida. Beier et al. (2003) also found poorly supported inferences regarding panther use of large forest patches, the quality of habitat in ENP and BCNP, and some vital rates used in inflexible population viability analysis (PVA) software.

Information Quality Act Challenge--The scientific process by design continually advances our collective understanding of the species and its needs for recovery. In 2004, an Information Quality Act challenge identified certain inconsistencies and shortcomings in some panther science. In response, FWS completed a series of tasks to clarify the record and collect, incorporate, and clearly describe new scientific information in its analyses. FWS remains committed to maximizing the quality, objectivity, utility, and integrity of the information it disseminates to the public. Furthermore, FWS welcomes input from colleagues to improve the quality of scientific information and optimize the conservation benefits achieved through the agency's programs.

K. Population Viability Analysis

Introduction--

PVA estimates the risk of extinction for a given population over a given time period (Shaffer 1981, Gilpin and Soulé 1986, Beissinger and Westphal 1998). In general, PVA models are relatively simple and rarely reflect the exact dynamics of a real population (Fieberg and Ellner 2000). PVA models are dependent upon quality input data (Doak et al. 1994) and how effectively the model itself reflects the life history of the species being modeled. However, PVA models used in conjunction with genetic and other benchmarks may help determine minimum population sizes (Shaffer 1981, Shaffer and Sampson 1985, Morris and Doak 2002) as well as metapopulation structure necessary to offset habitat fragmentation, catastrophes, and other threats (Pulliam et al. 1992, Hanski 2002).

A population is "viable" when it has the "capacity to maintain itself without significant demographic or genetic manipulation for the foreseeable ecological future—usually centuries—with a certain, agreed on, degree of certitude" (Soulé 1987). Shaffer (1981) first defined the "minimum viable population" for a given species in a given habitat as "the smallest isolated population having a 99% chance of remaining extant for 1000 years despite the foreseeable effects of demographic, environmental and genetic stochasticity and natural catastrophes." As Shaffer, Soulé, and others note, the choice of both the time horizon and the threshold is in fact arbitrary (Shaffer 1981, Soulé 1987, Boyce 1992, Grimm and Wissel 2004). Nonetheless, a literature review of empirically derived PVAs suggests that thresholds set at a 95 or a 99% chance of persistence (corresponding to a 5 or 1% chance of true extinction) over a 100-year time horizon are often used (Hamilton and Moller 1995, Horino and Miura 2000, Kelly and Durant 2000, Parysow and Tazik 2002, Kohlmann et al. 2005).

Even populations that persist beyond the stipulated time period may experience a reduction in population size or genetic variation rendering such populations vulnerable to inbreeding depression and / or genetic drift in subsequent generations. Thus, to offset declining mean population fitness as a result of inbreeding depression, Franklin (1980) and Soulé (1980) recommended effective population sizes (N_e) of 50 or more individuals, and Soulé et al. (1986) argued for a genetic threshold of no more than a 10% loss of heterozygosity over 200 years. To offset the erosion of genetic variability due to genetic drift, however, Franklin (1980) and Soulé (1980) recommended an effective population size of at least 500 individuals (see also Lande and Barrowclough 1987, Ewens 1990, Franklin and Frankham 1998). Based on empirical observations that detrimental mutations outnumbered beneficial and neutral ones, Lande (1995) argued for even larger effective population sizes on the order of 5,000 (but see Franklin and Frankham 1998). Finally, effective population sizes of between 10,000 and 100,000 may be necessary to maintain particularly beneficial traits (e.g., single-locus disease resistance factors) (Lande and Barrowclough 1987, Lande 1988). These varied estimates highlight the species-specific nature of the question.

The effective population size is substantially lower than the actual population size because of spatial structure, variance in family size, unequal sex ratios, and temporal fluctuations in population size (Wright 1969, Falconer 1989, Frankham 1995, Waples 2002). "However, one fairly well-substantiated generality is that for many birds and mammals $N_e / N \approx$ one-half to two-thirds, where N is the total population size of *reproductive adults* (Nunney 1993, Nunney and Elam 1994), arguing for a quasi-extinction threshold of at least 100 breeding adults" (Morris and Doak 2002). As Morris and Doak (2002) note, however, "this approach still basically ignores inbreeding problems and will always result in somewhat optimistic answers about population viability." Furthermore, metapopulation substructure is important because the total effective population size is not equal to the sum of the subpopulations and is most likely to be much higher than the sum (Wright 1943, Waples 2002).

Previous Florida Panther PVAs--

There have been at least six PVAs for the Florida panther (Seal and Lacy 1989, Seal and Lacy 1992, Cox et al. 1994, Ellis et al. 1999, Kautz and Cox 2001, Maehr et al. 2002b, Root 2004). The earliest of these, Seal and Lacy (1989) and Seal and Lacy (1992), used the VORTEX program to perform the PVA. The 1989 version predicted that "wholly isolated populations of less than 50 adult panthers (about 80 total adults, subadults, and juveniles) are not demographically stable even if the mean population growth rate, r, is positive." Even assuming that inbreeding has no deleterious effects on viability and reproduction, the predicted probability of extinction within 100 years was more than 14% (Seal and Lacy 1989). If inbreeding depression is assumed, the predicted probability of extinction within 50 years was "virtually certain" (Seal and Lacy 1989). Largely based on this PVA, the International Union for the Conservation of Nature and Natural Resources Captive Breeding Specialist Group recommended a vigorous captive breeding program.

In 1992, Seal and Lacy revised the VORTEX panther PVA, based on newer data for mortality and reproduction. Like the 1989 version, the 1992 version predicted the panther had a significant chance of extinction in 100 years and reduced genetic viability. For example, simulations of a population of 50 adult panthers with a positive mean population growth rate showed up to a 15% chance of extinction within 100 years in the absence of inbreeding and as much as a 35% chance with inbreeding (Seal and Lacy 1992).

Cox et al. (1994) and Kautz and Cox (2001) performed PVAs for 11 wildlife species, including the panther. Their models built on the earlier work of Shaffer (1987) by including catastrophic events. The Cox et al. (1994) PVA followed adult females only and incorporated a range of fecundity and survival values to simulate “favorable,” “moderate,” and “harsh” environmental conditions over 200 years. Under the “favorable” environment scenario (high survival and fecundity), 63 panthers had a 90% chance of persistence for 200 years. Under the “moderate” scenario (medium levels of survival and fecundity) 76 panthers and under the “harsh” scenario (low survival and fecundity) 84 panthers had the same chance of persistence.

Kautz and Cox (2001) added a genetic component to the Cox et al. (1994) PVA by using the technique described in Reed et al. (1988). Kautz and Cox estimated the size of a total population needed to obtain an effective population size of 50. The authors acknowledged that effective populations on the order of 100 - 1,000 times greater than 50 may be needed to ensure genetic variability over the long term; nonetheless, Kautz and Cox (2001) focused on the smallest population sizes likely to persist in the short term. By comparison, Reed et al. (2003) performed PVAs in VORTEX for 102 vertebrate species, including the panther, to estimate minimum viable populations (MVPs). Based on a subset (n = 38) of these species, Reed et al. (2003) determined that 5,800 adult animals were needed for a 95% chance of persistence over 40 generations, 4,700 for a 90% chance of persistence, and 550 for a 50% chance of persistence. Ultimately, Reed et al. (2003) concluded that management programs should conserve habitat capable of supporting approximately 7,000 adult vertebrates to ensure long-term persistence. This number was larger than other MVP estimates cited therein (Franklin 1980 [4,500], Newmark 1987 [greater than 3,250], Thomas 1990 [5,500], Schultz and Lynch 1997 [~2,000], Reed and Bryant 2000 [greater than 2,000], Whitlock 2000 [~2,000]).

Kautz and Cox (2001) assumed that as long as the effective population size does not drop below 50, opportunities will arise later for achieving larger populations and avoiding genetics problems through patch recolonization, translocation of individuals, or removal of environmental constraints on a population through management. Based on these assumptions, Kautz and Cox (2001) estimated that a census population of panthers in the range of 100 - 200 individuals is needed to achieve an effective population size of 50. However, this conclusion is based in part upon equating total metapopulation size with effective population size (see Wright 1943, Waples 2002).

Maehr et al. (2002b) used a "consensus" model, whereby five coauthors each provided initial conditions and parameter values for separate runs in VORTEX. These five "wildly divergent models produced divergent estimates of extinction risk" (Beier et al. 2003). If "discrepancies were more than slight, each author was asked to justify the variable in question" (Maehr et al. 2002b). The "agreement among 4 of 5 estimates of extinction risk was due to drastically differing, but fortuitously offsetting, assumptions between modelers" (Beier et al. 2003). If "a single view did not prevail, compromise was sought by averaging the five versions of the contentious variable" (Maehr et al. 2002b). This consensus model suggested a 98% chance of persistence for 100 years (Maehr et al. 2002b). According to Beier et al. (2003), this more "optimistic" outcome was due to some combination of 4 factors: (1) kitten mortality was simulated at 20% compared to 50% in earlier PVAs; (2) initial population size was set as 60 compared to 50 in earlier PVAs; (3) they assumed no loss of habitat compared to 1% annually in earlier PVAs; and (4) they assumed population augmentation in the form of two females per decade compared to none in earlier PVAs.

Ellis et al. (1999) reviewed the Seal and Lacy (1989), Seal and Lacy (1992), and Maehr et al. (2002b)[1] PVA models. Their review included a comparison of the parameter inputs for the three models as well as additional sensitivity analyses to explore expansion prospects and the effects of habitat loss on the south Florida population (Ellis et al. 1999). In general, their analysis demonstrated that these PVA models are fairly sensitive to changes in first-year mortality (i.e., kitten survival) (Ellis et al. 1999). For example, with low carrying capacity (100 - 200 individuals) and low first-year mortality (20 - 40%), the PVA models showed positive population growth, low probabilities of extinction (0 - 3%), and moderate losses of genetic diversity (15 - 27%) (Ellis et al. 1999). However, when first-year mortality is increased (50 - 60%), the probability of extinction rises dramatically (48 - 100%), and loss of genetic diversity is further accelerated (28 - 50%, 100% for the extinction scenario) (Ellis et al. 1999).

[1] Although Maehr et al. (2002b) was published in 2002, the actual PVA model was first presented in 1999. See Ellis et al. (1999).

Ellis et al. (1999) also determined that in some circumstances, the south Florida population could remain viable given low levels of emigration from the current population (i.e., 1% per year). However, viable expansion required members of the newly established population immigrating back into the current population as well as low first-year mortality (Ellis et al. 1999). Finally, simulations incorporating cumulative habitat losses of 25% and 50% over 25 years yielded significant probabilities of extinction for all but the lowest value of first-year mortality, ranging from 10% (assuming 30% first-year mortality and 25% habitat loss) to 98% (assuming 50% first-year mortality and 50% habitat loss) (Ellis et al. 1999).

Beier et al. (2003) recommended against the use of “canned programs” (e.g., VORTEX, RAMAS) and urged that future models take into account uncertainty in model parameters and functional relationships via sensitivity analyses. With the exception of Cox et al. (1994) and Kautz and Cox (2001), all of the panther PVA models were based on these canned programs. The PVA by Maehr et al. (2002b) did not include a sensitivity analysis. As Beier et al. (2006) note, understanding the sensitivity of PVA models to parameter changes may be more important than a precise estimate of extinction risk. Beier et al. (2003) also recommended that rigorous estimates of reproduction rates, survival rates, and variation in these rates, be incorporated into future PVAs. Finally, Beier et al. (2003) discouraged against “consensus” approaches (e.g., Maehr et al. 2002b) for inputting values because they lead to a “false sense of reliability.”

Recent Florida Panther PVA --

In 2002, Root constructed a PVA model to determine the minimum population size necessary for long-term persistence (100 years). Root’s PVA model was constructed using RAMAS GIS, a spatially-explicit PVA software program. Relying on less optimistic fecundity and survival values from Seal and Lacy (1989), Root's PVA model determined that there was no feasible number of panthers that would produce persistence probabilities greater than 75%, even if the initial population size was more than 1,000 females (or 2,000 total panthers, assuming a sex ratio of 1:1). Using more optimistic fecundity and survival values from Seal and Lacy (1989) corresponding to values needed to produce finite population growth rates much greater than 1.05, Root's PVA model determined that 25 females (50 total panthers) would provide a 95% probability of persistence for the next 100 years. Using input parameter estimates needed to produce finite growth rates near 1.05, the population size needed for long-term persistence increased to 51 females (102 total panthers). When the input parameter estimates were modified to reduce the finite growth rate still further to 1.03, Root's PVA model revealed that a panther population comprised of at least 120 females (240 total panthers) was required for long-term persistence.

Some of the PVA work done by Root in 2002 is now published (Root 2004), but the publication does not discuss specific target population sizes necessary for long-term persistence or include a sensitivity analysis. Similar to Cox et al. (1994) and Kautz and Cox (2001), Root's model only followed females and examined three basic sets of parameters. For the latter, Root (2004) used parameter values similar to those in Seal and Lacy (1989), Seal and Lacy (1992), and Maehr et al. (2002b). Root (2004) ran several variations of each set of parameters, including "different density dependence or none, various levels of habitat loss, intermittent catastrophes or epidemics, or scheduled translocations or reintroductions." In particular, Root (2004) calculated the potential impact on the panther population of a loss of 25% of habitat (1% per year for 25 years), or roughly the amount of private land within the Primary Zone. After 100 years under a moderate scenario with this habitat loss assumption, Root (2004) estimated a decrease in mean final abundance of 26%, and a 1% increase in the likelihood of extinction. However, even under the optimistic scenario she found the 25% habitat loss variation noted above greatly decreased mean final abundance.

Root (2004) also explored emigration (i.e., annual dispersal of female panthers to empty patches north of the Caloosahatchee River), finding that under the Seal and Lacy (1992) set of parameters, the probability of extinction actually increases over what it would have been without emigration. These preliminary results suggest the importance of carefully considering metapopulation structure not only in terms of subpopulation size, but also in terms of dispersal rates, prior to deriving MVPs (see also Sweanor et al. 2000, Frank 2005, Hellgren et al. 2005, McCarthy et al. 2005).

The FWS believes that Root (2004) represents the most current, reliable, and objective PVA model available today. We recognize that any model is only as good as the data / parameters estimates used. We are also aware of the deficiencies of this model (e.g., use of a "canned program", lack of sensitivity analysis) and realize that while the model included a variation for habitat loss approximating all private lands in the Primary Zone, several of the assumptions in the basic model (e.g., no change in amount, quality, or configuration of habitat; no difficulty finding mates; no catastrophies; no additional human-induced mortality) may be unrealistic. Recognizing these limitations, we believe the PVA analysis by Root (2004) represents the best available science at this time. Therefore, the Root (2004) PVA was used by the Recovery Team and FWS to aid in developing the population numbers for the reclassification and delisting criteria.

Implications--

There is insufficient habitat in south Florida to sustain a viable panther population and population expansion into south-central Florida will be difficult. Therefore, to achieve a viable population of 240 and to reclassify or delist the species, additional populations will have to be reintroduced into other areas within the panther's historical range. Unfortunately, the distances from the occupied range to potential reintroduction sites (Thatcher et al. 2006b) may far exceed the species' capability for demographic and genetic interchange. In the absence of migration between populations, each panther population will remain isolated and therefore vulnerable to environmental, demographic, and genetic stochasticity as well as catastrophic events (Gilpin and Soulé 1986). These isolated populations will be vulnerable to extinction in the short-term. However, the long-term persistence of the panther will depend on multiple populations that are spatially discrete and able to fluctuate independently from one another in response to catastrophic or other environmental perturbations. If each of these reestablished populations had a moderately low probability of extinction, localized environmental perturbations, and population fluctuations remained asynchronous, all other things being equal, it is highly improbable that the extinction of the panther would result from a simultaneous extinction of all populations (Seal and Lacy 1989, Carlson and Edenhamn 2000, Kendall et al. 2000, Reed 2004, Li et al. 2005).

In some cases, managed translocation among separate populations may be a cost-effective means of achieving multiple, viable populations (Goodman 1987, Lubow 1996). However, biological concerns such as landscape connectivity (Noss 1987, Root 1998, Beier 1993, Swart and Lawes 1996, Carroll et al. 2004, Kramer-Schadt et al. 2005), disease outbreaks (Hedrick et al. 2003), migration rates among populations (Brown and Kodric-Brown 1977, Mills and Allendorf 1996), demographic impacts on the donor populations (Saenz et al. 2002, Root 2004), population bottlenecks (Ralls and Ballou 2004), Allee effects (Mooring et al. 2004), inbreeding depression (Swinnerton et al. 2004), and random genetic drift (Gautschi et al. 2003) must be carefully considered prior to reintroduction. Furthermore, financial (Margan et al. 1998, van Heezik and Ostrowski 2001, Lindsey et al. 2005), socio-political (Musiani and Paquet 2004) and / or other factors may impose additional constraints on the efficacy of reintroducing multiple populations.

II. RECOVERY STRATEGY

The biological constraints that have to be taken into consideration when planning Florida panther conservation and management actions include the need for large, contiguous landscapes, the need for large prey for successful reproduction, very low population density, and low reproductive and colonization rates. The fact that the panther is a large predator requires human social considerations in its conservation and management.

Panthers are large, solitary carnivores and require large ranges to obtain the necessary prey (white-tailed deer and feral hogs) to meet energy needs required for health and reproduction. Their social and reproductive behavior requires access to large contiguous areas of suitable habitat to maintain viable breeding populations. Social intolerance (mutual avoidance), prey abundance, and specific habitat features are thought to regulate panther density. Females normally have a litter of kittens every other year. When the kittens are 14 - 24 months of age, the family bond is broken and the kittens leave their mother. Subadult males generally disperse and become somewhat nomadic, whereas subadult females generally set up home ranges very close to their natal ranges. For this reason, it can take a considerable amount of time for a population to colonize new areas.

Panthers are sometimes thought of as a wilderness indicator species, not because they require wilderness to live or cannot live in proximity to people, but because people will not usually tolerate panthers living in close proximity to them. People have historically been fearful of panthers due to concern for their livestock as well as their own lives. As humans encroach in panther habitat the likelihood of human-panther interactions increases. People's perceptions and attitudes about panthers will be a major determining factor in the success of panther recovery.

The recovery strategy for the Florida panther is to maintain, restore, and expand the panther population and its habitat in south Florida, expand this population into south-central Florida, reintroduce at least two additional viable populations within the historic range outside of south and south-central Florida, and facilitate panther recovery through public awareness and education. The panther depends upon habitat of sufficient quantity, quality, and spatial configuration for long-term persistence, therefore the plan is built upon habitat conservation and reducing habitat-related threats, but also addresses other key issues such as genetic viability. Range expansion and reintroduction of additional populations are recognized as essential for panther recovery. Similarly, fostering greater public understanding and support is necessary to achieve panther recovery.

Maintain, restore, and expand the panther population and its habitat in south Florida

Before delisting can occur, sufficient habitat quality, quantity, and spatial configuration must be maintained and protected in the long-term to support multiple viable populations. Consequently, habitat conservation will be necessary for recovery. Leading sources of panther mortality (vehicular collisions and intra-specific aggression), impediments to population expansion and subsequent gene flow, and biological constraints on population growth and other life history traits also are habitat-related. Therefore, those actions that maintain, restore, and expand panther habitat generally are critical for conservation and recovery.

The Primary Zone supports the only breeding panther population. To prevent further loss of population viability, habitat conservation efforts should focus on maintaining the total available area, quality, and spatial extent of habitat within the Primary Zone. The continued loss of habitat functionality through fragmentation and loss of spatial extent pose serious threats to the conservation and recovery of the panther. Therefore, conserving lands within the Primary Zone and securing biological corridors are necessary to help alleviate these threats.

The Secondary Zone consists of lands that have the potential to support an expanding panther population. However, these lands contain lower quality habitat comprised of high intensity agriculture, a patchwork of residential subdivisions, and golf course communities. Restoration would need to occur to allow this area to contribute meaningfully to panther recovery. Because these lands require extensive restoration in some areas and may not contribute to panther recovery for some time, their conservation is considered a lower priority than conservation of the Primary and Dispersal Zones (Kautz et al. 2006).

Roads are a significant source of panther mortality and habitat fragmentation in south Florida. Therefore, necessary actions include the identification and prioritization of locations needing crossing and fencing installation, as well as collaborative efforts by transportation agencies, landowners, and local communities to ensure that future roads and road expansion projects are designed and constructed with regard to panther conservation. Several highway segments are particularly problematic for panthers because the adjacent lands are privately owned. Installation of highway crossings and fencing along sensitive highway segments will require cooperation with private landowners.

Approximately one-fourth of the Primary Zone, two-thirds of the Secondary Zone, and nearly all of the Dispersal Zone are in private ownership (R. Kautz, pers. comm. 2005). Therefore, conservation and restoration of Primary, Secondary, and Dispersal Zone habitat will require cooperation with private landowners not only as willing sellers, but also as willing participants in conservation easements or other habitat management programs for the panther. Actions that emphasize cooperative efforts and landowner incentives, particularly those designed to discourage conversion of land to less suitable habitat are important.

The majority of the Primary Zone is on public lands, and panther survival will depend upon public land managers to ensure that panthers and their prey are considered in management efforts. Important tools for success will include development and implementation of best management practices for panther habitat; formalizing a network of south Florida public land managers; preparation, review, and implementation of State and Federal habitat management plans for public lands; and a tracking system to determine the effects of habitat loss and conversion on panthers.

Although the genetic restoration program initiated in 1995 was successful (Pimm et al. 2006a), the existing population size is not sufficient to offset genetic drift in the long-term. At current population levels, the loss of donor individuals to future expansion and / or reintroduction efforts may pose an added risk to the existing population (Root 2004). Therefore, developing and implementing a genetics management program to determine appropriate protocols for translocating or removing panthers as well as gauging the progress of the restoration effort is important. Related to this effort is the need to continue monitoring physical and physiological characteristics correlated with inbreeding and loss of genetic variability. A PVA model is being developed by FWC that should assist in ensuring that these management actions do not impair the long-term persistence of existing and future panther populations.

The small size and high degree of isolation of the existing panther population also makes it vulnerable to catastrophic events such as disease or parasite outbreaks. Actions that support continued monitoring and determination of the presence, infection rate, mortality rate, and consequences of known and unknown diseases and parasites are important.

Provide for the expansion of the breeding population into south-central Florida

Dispersing male panthers from the south Florida population have immigrated into south-central Florida, but an absence of females has inhibited expansion of the breeding population into this area (Belden and McBride 2006). The primary considerations to expanding the breeding population of panthers into south-central Florida are to determine whether suitable habitat exists, whether people there will accept panthers, if there are sufficient panther numbers in the age and sex classes necessary for expansion, and methods of expanding the population. Studies by Belden and McBride (2006) and Thatcher et al. (2006a) evaluated habitats in south-central Florida and identified areas that might provide favorable habitat conditions (Figure 5). Even though some suitable panther habitat remains in this region, it occurs in widely scattered and relatively small patches that are fragmented by major highways and agricultural and urban development. It is estimated that these areas could support 20 to 40 panthers (Belden and McBride 2006, Thatcher et al. 2006a). Development pressure and human population growth will decrease the opportunity for panther expansion north of the Caloosahatchee River.

The Dispersal Zone requires protection from development to provide a corridor to facilitate dispersal from south Florida to potentially suitable habitat north of the Caloosahatchee River. Maintaining connectivity is important not only to facilitate dispersal, but to enhance population exchange once female panthers have been reestablished in south-central Florida.

Given the limited dispersal rates of female panthers and the present lack of suitable habitat conditions in the Dispersal Zone, it is likely that human intervention will be required to establish females north of the Caloosahatchee River (Thatcher et al. 2006a). In this case, the feasibility of panther translocation will need to be evaluated, including an EA or Environmental Impact

Statements (EIS) under the NEPA process if necessary, and a translocation plan developed. This plan should include an evaluation of public acceptance, consideration of the effects on potential reintroductions elsewhere in the historic range, and consideration of the effects on the south Florida breeding population. Any expansion plan should include education and outreach to increase public understanding of panther behavior and recovery needs prior to, during, and after the translocation of panthers.

Establish viable populations of the panther in potential reintroduction areas

The panther has been restricted to less than 5% of its historic range and the current panther population is not considered viable. Recovery will require reintroduction to establish viable populations in other parts of its historic range. The strategy is to utilize existing studies and computer models along with field surveys to confirm potential reintroduction sites. These potential reintroduction sites will be further refined in coordination with agencies and the public in other southeastern states. This will include conducting preliminary public scoping, conducting field surveys, and using the NEPA process to develop and refine the appropriate reintroduction alternatives. Once a site is chosen, protocols will need to be developed to determine the number of panthers from each age and sex class that are needed and which individuals are the best candidates for release, methods of release, and monitoring. Education and outreach efforts will be needed to address social concerns before and after panthers are released.

Identify, secure, maintain, and restore habitat in potential reintroduction areas

The strategy for conserving habitat in potential reintroduction areas will need to mirror that for conserving habitat in the currently occupied range. The ability of potential reintroduction sites to support panthers will depend on land managers to ensure that the needs of both panther and prey are adequately considered. It will be important to develop and implement best management practices for panther habitat; formalize local networks of land managers; prepare, review, and implement habitat management plans; and develop a tracking system to determine the effects of habitat management on panthers. Those actions that prevent habitat loss, degradation, and fragmentation as well as maximize connectivity and spatial extent in reintroduction areas are important for reintroduction. Actions that involve identification and prioritization of areas for road crossing and fencing installation are essential. Similarly, collaborative transportation planning efforts that ensure future roads and road expansion projects are designed and constructed with regard to panther conservation are high priorities.

Facilitate panther recovery through public awareness and education

Public awareness and support are essential for panther conservation and management activities, as well as for reintroduction efforts. Previous social surveys and biological field research related to panther recovery efforts have identified the importance of public education and outreach programs, including development of a media plan. The strategy is to build support through education and outreach programs that increase public understanding of panther behavior and recovery needs. Social science research will identify public opinion and knowledge levels which are important in developing materials and programs; these will be provided to local planning organizations, decision makers and elected officials, the public, major landowners, residents living in and adjacent to panther habitat, the realtor community, and other audiences. Education and outreach efforts will be evaluated, especially to assess human attitude and behavior changes toward panthers.

III. RECOVERY GOAL, OBJECTIVES, AND CRITERIA

Recovery Goal

The goal of this recovery plan is to achieve long-term viability of the Florida panther to a point where it can be reclassified from endangered to threatened, and then removed from the Federal List of endangered and threatened species.

Recovery Objectives

1. To maintain, restore, and expand the panther population and its habitat in south Florida and expand the breeding portion of the population in south Florida to areas north of the Caloosahatchee River.

2. To identify, secure, maintain, and restore panther habitat in potential reintroduction areas within the historic range, and to establish viable populations of the panther outside south and south-central Florida.

3. To facilitate panther recovery through public awareness and education.

Recovery Criteria

The quantitative criteria for the interim goal, reclassification, and delisting are based upon threats to the panther, PVAs, and the need to address representation, resiliency, and redundancy (Shaffer and Stein 2000 cited in National Marine Fisheries Service 2004). Representation is conserving the breadth of the genetic makeup of the species to conserve its adaptive capabilities. Resiliency is ensuring that each population is sufficiently large to withstand stochastic events. Redundancy is ensuring a sufficient number of populations to provide a margin of safety for the species to withstand catastrophic events.

Kautz et al. (2006) developed population guidelines based on the results of the previous Florida panther PVA (i.e., Root 2004). Following these guidelines, populations of greater than 240 have a high probability of persistence, low probability of extinction over 100 years, are able to retain 90% of their heterozygosity (representation), and can tolerate some habitat loss or mild catastrophes. Populations within the 80 to 100 range are likely stable with a low probability of extinction for 100 years, have slowly declining heterozygosity, and are vulnerable to habitat loss or catastrophes. According to Root (2004), these models indicate that unless we are able to safeguard the current condition, amount, and configuration of the occupied panther habitat, the long-term viability of the panther is not secure. In addition, Kautz et al. (2006) suggests that unavoidable losses in the Primary Zone should be offset by habitat restoration or enhancement of habitat elsewhere in the Primary Zone, thereby increasing the functional value and carrying capacity of the remaining habitat. As a result, it is clear that conservation strategies should be used to maximize protection and restoration, if needed, in the Primary Zone. The south Florida panther population, which documented panther counts suggest is roughly 100 - 120 individuals, is obviously the foundation for all efforts to expand and/or reintroduce panthers into other parts of the species' historic range. We have seen the panther population increase since the genetic restoration effort, and protecting and maintaining habitat in the appropriate configuration to support a stable population is a necessary component of recovery efforts in the future.

PVA models are no better than the data upon which they are based, and it cannot be overemphasized that the Root (2004) basic models assume no difficulties in finding mates, no additional human-induced mortality, and no intermittent catastrophic events. In addition, aside from the 25% habitat loss variation that approximates the loss of all privately owned land in the Primary Zone, the Root (2004) models assume that there was no change in amount, quality, or configuration of habitat during 100 years of simulation. Since many of these unrealistic assumptions represent a significant departure from conditions in south Florida and the Southeast, recovery criteria need to include more than one population (resiliency and redundancy) to safeguard against habitat loss (a major threat) and stochastic catastrophic events (e.g., disease outbreaks or major hurricanes). It is difficult to predict the extent to which future catastrophic events will impact the panther. However, two viable populations would be sufficient for reclassification and three viable populations would provide an adequate margin of safety for full recovery. Meeting these criteria would indicate that threats are ameliorated, the panther is sufficiently genetically represented, and its security is achieved through resiliency and redundancy.

A. Reclassification to Threatened

Reclassification will be considered when:

EXHIBIT 22

1. Two viable populations of at least 240 individuals (adults and subadults) each have been established and subsequently maintained for a minimum of twelve years (two panther generations; one panther generation is six years [Seal and Lacy 1989])..

2. Sufficient habitat quality, quantity, and spatial configuration to support these populations is retained / protected or secured for the long-term.

A viable population, for purposes of Florida panther recovery, has been defined as one in which there is a 95% probability of persistence for 100 years. This population may be distributed in a metapopulation structure composed of subpopulations that total 240 individuals. There must be exchange of individuals and gene flow among subpopulations. For reclassification, exchange of individuals and gene flow can be either natural or through management. If managed, a commitment to such management must be formally documented and funded. Habitat should be in relatively unfragmented blocks that provide for food, shelter, and characteristic movements (e.g., hunting, breeding, dispersal, and territorial behavior) and support each metapopulation at a minimum density of 2 to 5 animals per 100 square miles (259 square kilometers) (Seidensticker et al. 1973, Logan et al. 1986, Maehr et al. 1991a, Ross and Jalkotzy 1992, Spreadbury et al. 1996, Logan and Sweanor 2001, Kautz et al. 2006), resulting in a minimum of 4,800 – 12,000 square miles (12,432 – 31,080 square kilometers) per metapopulation of 240 panthers. The amount of area needed to support each metapopulation will depend upon the quality of available habitat and the density of panthers it can support.

B. Delisting

Delisting will be considered when:

1. Three viable, self-sustaining populations of at least 240 individuals (adults and subadults) each have been established and subsequently maintained for a minimum of twelve years.

2. Sufficient habitat quality, quantity, and spatial configuration to support these populations is retained / protected or secured for the long-term.

For delisting, exchange of individuals and gene flow among subpopulations must be natural (i.e., not manipulated or managed).

C. Interim

Due to the challenging nature of attaining the recovery criteria, an interim recovery goal has been established to assist in determining progress towards the ultimate goals of reclassification and delisting.

This interim goal is to achieve and maintain a minimum of 80 individuals (adults and subadults) in each of two reintroduction areas within the historic range and to maintain, restore, and expand the south / south-central Florida subpopulation.

The interim goal will be met when:

1. The south / south-central Florida panther subpopulation has been maintained, restored, and expanded beyond 80 to 100 individuals (adults and subadults).

2. Two subpopulations with a minimum of 80 individuals each have been established and maintained within the historic range.

3. Sufficient habitat quality, quantity, and spatial configuration to support these three subpopulations is retained / protected or secured for the long-term.

There must be exchange of individuals and gene flow among these subpopulations. This exchange of individuals and gene flow can be either natural or through management.

IV. RECOVERY ACTION OUTLINE AND NARRATIVE

Existing Population

1. **To maintain, restore, and expand the panther population and its habitat in south Florida and expand the breeding portion of the population in south Florida to areas north of the Caloosahatchee River to maximize the probability of the long-term persistence of this metapopulation.**

South Florida

1.1. **Maintain, restore, and expand the panther population and its habitat in south Florida.**

South Florida Habitat

1.1.1. **Maintain the ability of the Primary, Secondary, and Dispersal Zones, as identified in Kautz et al. (2006), to contribute to a viable population.** Maintain the quantity and quality of habitat in the Primary Zone, maintain the quantity and improve the quality in the Secondary Zone, and increase the quantity of protected acres and enhance the quality of the Dispersal Zone. The Dispersal Zone needs to provide the connection between south and south-central Florida and provide for expansion of the population. This indicates the need for an accounting of habitat in Primary, Secondary, and Dispersal Zones, tracking acres lost and restored over time. This leads to a need for a mechanism to mitigate impacts.

Non-Regulatory Incentive Programs

1.1.1.1. **Use and coordinate all non-regulatory incentive programs to maintain and secure habitat on private lands.**

1.1.1.1.1. **Develop Safe Harbor Agreements** with willing landowners.

1.1.1.1.2. **Focus available incentive programs to restore and enhance habitat.** Coordinate implementation of existing programs (e.g., Farm Bill, Partners for Fish and Wildlife Program, Landowner Incentive Program, Rural Land Stewardship Program, Stewardship America Program) within and among agencies.

1.1.1.1.3. **Explore the creation of new panther conservation incentive programs** that compensate, pay, or otherwise provide economic incentives for landowners to provide for panthers and panther habitat on their lands.

1.1.1.1.4. **Continue to secure lands**, both fee simple and conservation easements, through existing and / or new land acquisition programs including Federal, State, county, and non-governmental organization programs. Ensure terms of conservation easements address panther needs and are consistent among agencies.

1.1.1.1.4.1. **Revise and implement the preliminary project proposal developed for expansion of FPNWR** incorporating the landscape conservation strategy maps (Kautz et al. 2006) and the results of Collier County's land use planning efforts.

1.1.1.1.4.2. **Modify existing land appraisal procedures** to allow government agencies to offer more than the appraised value for private lands that support panthers. Higher acquisition costs may be justifiable based on quality habitat because of greater long-term costs of both purchase and restoration of degraded habitat.

1.1.1.1.4.3. **Conduct an annual review of Florida Forever projects and rate them with respect to panther conservation values.** This report should be sent to the Governor and Cabinet of the State of Florida.

1.1.1.1.5. **Identify and support local initiatives to protect habitat and purchase development rights.** Encourage, assist, and provide resources to local governments to develop and implement land use plans that complement and advance panther recovery.

Regulatory Programs

1.1.1.2. **Appropriately use local, State, and Federal regulatory programs to maximize their ability to maintain the overall quality, quantity, and functionality of habitat.**

1.1.1.2.1. **Create a Federal / State working group to coordinate permit review and consultation.** The purpose of this group would be to ensure coordination and cooperation between Federal and State programs that provide biological opinions and recommendations to permitting authorities.

1.1.1.2.2. **Track permits, especially incidental take and compensation received, issued through Federal and State regulatory programs** to determine the impacts on panthers of landscape and land use changes.

1.1.1.2.3. **Develop and implement regulatory procedures and guidance that avoid habitat loss, degradation, and / or fragmentation as a result of federally funded or authorized projects and actions.** If incompatible development, conversion of natural habitat types, and / or land use intensification cannot be avoided then such procedures and guidance should ensure that equivalent habitat protection and restoration are provided, especially within the Primary Zone, to compensate for both the quantity and functional value of the lost habitat.

1.1.1.2.3.1. **Ensure that panther conservation and protection of habitat is included in the State Clearinghouse (SAI) reviews of Federal activities** and identify any actions that would be inconsistent with the Federal Coastal Zone Management Plan and NEPA.

1.1.1.2.3.2. **Ensure that the section 7 consultation process is utilized and that the best available science is used in development of biological opinions.**

1.1.1.2.3.3. **Avoid adverse effects to habitat (including prey) attributable to CERP and other water management projects.** Identify and monitor effects of water management projects; adverse effects should be avoided. If that is not possible, they should be minimized and appropriate compensation provided.

1.1.1.2.4. **Develop and implement regulatory procedures and guidance that avoid habitat loss, degradation, and / or fragmentation as a result of State or locally authorized projects that are not a part of a Federal review process.**

1.1.1.2.4.1. **Provide review and recommendations to FDEP, Department of Community Affairs, WMDs, and other State agencies on permit applications that can potentially impact habitat.**

1.1.1.2.4.2. **Work with counties and municipalities to modify and amend Comprehensive Plans to include the goal of no net loss of quantity, quality, or functionality of habitat in Primary, Secondary, and Dispersal Zones.**

1.1.1.2.4.3. **Develop a mechanism for providing compensation for projects that affect small acreages (e.g., single family residences) of habitat.** An effective mechanism will address loss of habitat and also cumulative degradation of habitat and could include panther conservation banks and / or regional off-site mitigation banks.

1.1.1.2.4.4. **Initiate and encourage landscape level HCPs where proposed non-Federal actions or projects will impact panthers or their habitat.** Explore partnering with counties through their growth management plans to develop HCPs. Priority for conservation should be directed towards the Primary Zone.

Habitat Fragmentation, Connectivity, and Spatial Extent

1.1.1.3. Prevent habitat fragmentation, promote connectivity, and maintain spatial extent within panther habitat.

1.1.1.3.1. Identify, restore, maintain, and enhance habitat corridors to facilitate movements by resident panthers, promote dispersal, and prevent peripheral areas from becoming further isolated from habitat in the Primary Zone.

1.1.1.3.1.1. Quantitatively assess factors that define dispersal corridors and use least-cost pathways analysis to identify potential habitat corridors.

1.1.1.3.1.2. Restore habitat in potential corridors identified by least-cost pathways analysis.

1.1.1.3.1.3. Maintain and enhance existing habitat corridors.

1.1.1.3.1.3.1. Secure the Dispersal Zone through fee simple acquisition, compensation, or conservation easements.

1.1.1.3.1.3.2. Secure Camp Keais Strand to maintain connectivity from FPNWR to Corkscrew Regional Ecosystem Watershed.

1.1.1.3.1.3.3. Secure a corridor between BCNP and Okaloacoochee Slough to assure this pathway is not degraded or severed.

1.1.1.3.1.3.4. Consider maintenance of habitat corridors for panthers during Everglades restoration to avoid isolation of the ENP subpopulation. High water levels in Shark River Slough may prevent panthers from moving in and out of ENP, thus separating them from the rest of the population.

1.1.1.3.2. Maintain spatial extent and arrangement of habitat. Areas currently used by panthers and habitat conditions within the Primary Zone should be maintained. According to Root (2004), “Unless the current condition, amount, and configuration of the currently occupied panther habitat are safeguarded, the long-term viability of the panther is not secure.” In addition, Kautz et al. (2006) suggests that unavoidable losses in the Primary Zone should be offset by habitat restoration or enhancement of habitat elsewhere in the Primary Zone, thereby increasing the functional value and carrying capacity of the remaining habitat. Restoration of the Secondary Zone will help maintain spatial extent.

Negative Impacts of Roads on Panther Habitat – South Florida

1.1.1.4. Prevent and minimize the negative impacts of roads to panther habitat. Least cost path analysis, individual based models, and other modeling tools may be used to predict highway stretches that panthers are likely to cross (Carroll et al. 2004, Wikramanayake et al. 2004, Kramer-Schadt et al. 2005, Swanson et al. 2005). These same models may characterize habitat use adjacent to dangerous stretches of highway. This information should then be combined with field observations, home range data, and panther-vehicle collision data to identify and prioritize locations for wildlife crossings, to cluster habitat restoration and mitigation adjacent to these crossing areas, to identify other adjacent habitat used by panthers that needs added protection, and to connect the crossing areas and adjacent habitat with corridors to safer habitat.

1.1.1.4.1. Ensure that panther habitat needs are incorporated in the planning of new roads and road expansion projects. Examine future land use projections to assess expected effects of habitat fragmentation from roads. Utilize the ETDM process. Ensure early and continued coordination among agencies and local governments for all road projects in panther habitat. Develop Memorandums of Understanding (MOU) and / or refine pre-coordination procedures with State Department of Transportation and local governments for proactive assessment and pre-planning of road projects.

1.1.1.4.2. Identify current and planned roads that could affect panthers, eliminate roads where possible, and retrofit priority areas with crossings and fencing as appropriate to promote connectivity and dispersal. Develop and distribute recommendations on improvements needed for specific road segments.

1.1.1.4.3. Secure habitat adjacent or contiguous to areas of high risk for panther-vehicle collisions.

1.1.1.4.4. Determine the impacts of roads on range expansion and dispersal.

Habitat Restoration in Primary, Secondary, and Dispersal Zones

1.1.2. Restore habitat in the Primary, Secondary, and Dispersal Zones.

1.1.2.1. Identify and prioritize tracts suitable for restoration.

1.1.2.2. Provide incentives and mechanisms for restoration of agricultural and range lands.

1.1.2.3. Develop / expand funding mechanisms and other incentives for habitat restoration.

1.1.2.4. Develop and disseminate information on cost-effective restoration techniques.

1.1.2.4.1. Facilitate and conduct habitat restoration research.

1.1.2.4.2. Monitor and evaluate restoration projects and report the reasons for successes and failures.

Habitat Management – South Florida

1.1.3. Encourage habitat management that provides for the needs of panthers and their prey.

1.1.3.1. Develop, disseminate, and implement best management practices for managing habitat. Develop in coordination with Federal, State, local and private entities.

Public Land Management – South Florida

1.1.3.2. Ensure that panthers and their prey are adequately considered and provided for in management of public lands. Management of public lands should include, but is not limited to, restoration and maintenance of natural habitat through prescribed fire, invasive plant control, regulation of ORV use as appropriate, restoration and maintenance of hydrologic quality and quantity, and regulation of recreational hunting to ensure that it does not negatively impact the panthers' prey base.

1.1.3.2.1. Formalize a network of south Florida public land managers to encourage exchange of panther information and facilitate the development and implementation of effective land management actions. This group should consider the need for interagency panther habitat management strike teams to capitalize on and share existing resources to implement habitat management priorities on the various public lands in south Florida (e.g., cooperative efforts for prescribed burning and invasive plant control).

1.1.3.2.2. Prepare, review, and implement habitat management plans for public lands to ensure that panthers and their prey are adequately considered and provided for. Plans should include active, state-of-the-art management tools including prescribed fire where appropriate.

1.1.3.2.3. Track habitat management activities and their effects on panthers by developing and distributing annual reports that summarize land management accomplishments and effects.

Private Land Management – South Florida

1.1.3.3. Encourage habitat management on private lands to adequately provide for panthers and their prey.

1.1.3.3.1. Provide incentives and assistance to willing landowners (see 1.1.1.1.2 and 1.1.1.1.3) to manage their lands for panthers and their prey using tools such as prescribed fire and invasive plant control. Focus and coordinate existing incentive programs within panther habitat.

1.1.3.3.2. Provide incentives and work with landowners to encourage them not to convert their lands to less suitable habitat.

1.1.3.3.3. Review and comment on county stewardship plans.

Monitoring Habitat – South Florida

1.1.4. Monitor habitat quantity and quality, land use changes, and response of the population to these changes (e.g., distribution, density, dispersal, reproductive success, mortality). Track land protection and habitat restoration with an emphasis on identifying where habitat is lost and restored.

1.1.4.1. Quantify 24-hour habitat use and movement patterns. More data are needed during hours of peak activity. Obtain and analyze data on nocturnal locations of panthers throughout their range to get a complete picture of panther habitat use.

1.1.4.2. Update Kautz et al. (2006) maps every five years to assess trends in habitat quantity and spatial configuration.

South Florida Population

1.1.5. Achieve and maintain the largest possible healthy panther population in south Florida using management practices that are consistent with ecosystem conservation. In addition to habitat conservation measures referenced in other sections of the plan the following measures are appropriate.

Demographics

1.1.5.1. Continue to monitor population viability.

1.1.5.1.1. Convene a group of agency and independent experts to conduct an appropriate PVA (existing or customized) and corresponding sensitivity analysis. Obtain independent peer-review.

1.1.5.1.2. Continue to determine and monitor demographic variables including age- and sex-specific reproduction and survival rates, litter size, recruitment, age at first reproduction, birth interval, proportion of individuals breeding, age and sex specific causes of mortality (including intraspecific aggression), dispersal, density, and minimum documented population size. Identify, evaluate, and use the least intrusive monitoring techniques or indices as appropriate (e.g., hair / genetics sampling, scats, cameras).

1.1.5.1.3. Develop and implement annual capture and monitoring work plans

Genetic Diversity

1.1.5.2. Maintain and enhance genetic diversity.

1.1.5.2.1. Continue to monitor physical and physiological characteristics correlated with inbreeding and depletion of genetic variability including kinked tails, cowlicks, cryptorchidism, sperm morphology, heart defects, immune function, and reproductive success.

1.1.5.2.2. Develop and implement a genetics management plan. Convene a working group of geneticists, reproductive physiologists, veterinarians, and population biologists to develop a genetics management plan. Use field observations, existing data, and results from the genetic restoration and management project initiated in 1995. The plan might include protocols and triggers (e.g., specific alleles, physical attributes, percent representation, studbook) for translocating, adding, or removing animals; a protocol for managing / preventing overrepresentation by specific lineages; the disposition of animals that may need to be removed; and specific monitoring needs.

1.1.5.2.3. Develop a population model to predict future genetic consequences of management proposals and actions.

Harassment, Injury, and Mortality

1.1.5.3. Monitor and take action to prevent harassment, injury, and mortality.

Harassment

1.1.5.3.1. **Reduce and eliminate illegal harassment and implement management strategies to prevent future harassment stemming from human activity**. Harass is defined by the FWS as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns, which include, but are not limited to, breeding, feeding, or sheltering. Harassment is considered a form of "take" as defined in the ESA. This does not include activities permitted by the FWS for panther management. Such permits may be issued by FWS to other Federal land management agencies or State conservation agencies.

1.1.5.3.1.1. **Identify harassment activities.** These could include, but are not limited to, illegal stalking of panthers, chasing panthers with dogs, pursuing panthers with ORVs, destruction of denning sites in an effort to relocate an animal, intentionally drawing a panther into an area (whether by baiting with live prey, illegal feeding, or other means) for photography or other purpose, and excessive noise-making activities.

1.1.5.3.1.2. **Implement active management measures designed to inhibit and / or cease illegal harassment activities on public lands.** Active management measures that can be implemented on public lands may include:

1.1.5.3.1.2.1. **Manage public access to minimize harassment opportunities.**

1.1.5.3.1.2.2. **Develop ORV management plans where ORVs are allowed.** Plans should contain actions that minimize impacts to panthers.

1.1.5.3.1.2.3. **Enforce regulations and statutes regarding discharge of firearms, explosive devices, or other loud noise sources.**

1.1.5.3.1.3. **Increase compliance with existing Federal and State laws and regulations prohibiting harassment.**

1.1.5.3.1.3.1. **Post and maintain regulatory and informational signs.** The effective use of on-site regulatory and informational signs is essential in providing the public with information on prohibited harassment activities (including the legal consequences and fines). This may contribute to better compliance.

1.1.5.3.1.3.2. **Enforce existing laws and regulations to prohibit harassment.**

Illegal Killing

1.1.5.3.2. Enforce existing Federal and State laws and regulations to minimize and prevent illegal killing.

Road Mortalities

1.1.5.3.3. Minimize and prevent injuries and mortalities by modifying conditions on existing roads and implement appropriate actions to protect panthers during the planning, permitting, and construction of new roads and highway expansion projects.

1.1.5.3.3.1. Identify and address existing and potential panther-vehicle collision areas to develop recommendations on improvements needed for specific road segments.

1.1.5.3.3.1.1. Convene a working group to prioritize and address actions needed in panther-vehicle collision areas.

1.1.5.3.3.1.2. Secure funding for and install wildlife crossings and fencing in high risk areas.

1.1.5.3.3.1.3. Evaluate and implement other mechanisms to prevent mortalities on roads including installing signs, creating wider shoulders, slower speed limits and speed zones, changing road elevations, and reducing traffic volume with no truck zones or adjusting tolls to encourage alternative routes (e.g., removing tolls on I-75 to reduce traffic on U.S. 41).

1.1.5.3.3.2. Build mechanisms into permits for road projects to provide for adaptive management for panther mortality and / or other unforeseen problems. These could include conditions for when the FWS will reinitiate consultation pursuant to section 7 of the ESA or require additional project alterations to avoid impacts.

1.1.5.3.3.3. Develop new strategies to prevent road mortalities or injuries including alternative technologies and new fencing designs that might be more aesthetically acceptable.

1.1.5.3.3.4. Enforce existing speed zones, monitor effectiveness, and modify as needed.

Research Caused Injuries and Mortality

1.1.5.3.4. Minimize harassment, injury, and mortality that could result from research, management, and monitoring programs. Ensure that research, management, and monitoring are directed at achieving priority needs of the recovery program and are conducted using the least intrusive and risky methods necessary to meet the objectives of the plan. Allow only highly trained and experienced individuals to capture panthers.

1.1.5.3.4.1. Provide adequate resources and facilities for rehabilitation of panthers that might be injured or orphaned during capture and monitoring efforts.

1.1.5.3.4.2. Develop, implement, review, and revise protocols (i.e., research, monitoring, capture, handling) as needed to minimize risks to panthers.

Diseases and Parasites

1.1.5.4. Monitor diseases and parasites and develop and implement appropriate management strategies.

1.1.5.4.1. Devise appropriate biomedical strategies to limit population level disease threats.

1.1.5.4.1.1. Continuously evaluate the value of specific vaccinations and review all vaccination protocols annually.

1.1.5.4.1.2. Revise vaccination protocols as appropriate considering new disease threats as they arise.

1.1.5.4.2. Determine and monitor the presence, infection rate, mortality rates, and consequences of diseases and parasites in the population.

1.1.5.4.2.1. Collect appropriate tissue and blood samples from all panthers handled, both live and dead, and analyze them for the presence of priority diseases and parasites, summarize and report results annually.

1.1.5.4.2.2. Evaluate the disease threats presented by other species including bobcats and domestic cats and identify any needed management intervention.

1.1.5.4.2.3. Implement appropriate management strategies for disease and parasite monitoring and control.

Environmental Contaminants

1.1.5.5. Identify and minimize the detrimental effects of environmental contaminants.

1.1.5.5.1. Produce a summary report and database of contaminants in panthers and their environment in south Florida. Identify contaminants and sources of concern and determine management implications.

1.1.5.5.2. Continue to monitor contaminants, especially mercury and endocrine disruptors, in panthers and their prey by collecting and analyzing appropriate tissue samples, summarize and report results.

1.1.5.5.3. Implement actions necessary to remediate contaminants in high risk areas.

Prey Base

1.1.5.6. Ensure an ample, healthy, and diverse prey base. Work with managers of public, private, and Tribal lands.

Deer

1.1.5.6.1. Continue active management of white-tailed deer populations.

1.1.5.6.1.1. Assess and monitor the status of deer populations in panther habitat.

1.1.5.6.1.2. Develop deer harvest regulations that do not compromise the panther prey base and take into consideration food requirements of the panther.

1.1.5.6.1.3. Continue to monitor the impacts on panthers of hunting on public and private lands in panther habitat including BCNP and State lands in south Florida.

Hogs

1.1.5.6.2. Encourage management / control of feral hog populations that does not threaten the panther. Develop a long-term strategy for hog management on public lands given potentially conflicting needs of the panther and agency policy to eradicate exotic species. Continue to assess the role of hogs in the panther prey base as this strategy is implemented.

Prey Diseases

1.1.5.6.3. Monitor prey diseases and attempt to prevent possible spread into south Florida.

1.1.5.6.3.1. Continue statewide monitoring for chronic wasting disease and other emerging wildlife and domestic animal diseases and implement available eradication or control methods.

1.1.5.6.3.2. Identify, map, and appropriately monitor and regulate exotic animal operations that could serve as a source of infection for wild populations.

1.1.5.6.3.3. Coordinate with the southeastern States to review protocols and regulations that require imported ungulates to be disease-free.

Captive Management

1.1.5.7. Address issues related to captive panthers and their potential for positively impacting the wild population.

1.1.5.7.1. Develop guidance for the removal of panthers from the wild. This guidance will address removal of individuals for disease containment and survival (e.g., orphaned or abandoned kittens, injured individuals). Appropriate protocols will be generated for the specific reason for removal (e.g., hand-rearing protocols for kittens).

1.1.5.7.2. Evaluate the need for and establish, if necessary, a captive breeding program. This program would be for the maintenance of a captive population (if indicated) and / or for individuals for reintroduction (see 2.2.1.3.).

1.1.5.7.3. Evaluate the role of alternative breeding strategies including artificial insemination and surrogate mothers that could provide a source of panthers to increase numbers or distribution**.**

1.1.5.7.4. Develop and implement a captive management plan for panthers held in captivity.

1.1.5.7.4.1. Form a captive management working group. This working group should consist of one representative from each institution maintaining or likely to maintain Florida panthers, the panther project veterinarian, and a representative of the FWS, FWC, and

NPS. Institutional representatives will consist of veterinarians, curators, or other staff involved in panther husbandry.

1.1.5.7.4.2. Develop a captive management plan. The captive management team should develop a plan as a guide for the placement and maintenance of panthers held in captivity. This plan should include preventative health, husbandry, reproduction, and captive population management.

1.1.5.7.4.3. Implement the captive management plan. Participating institutions will be signators of a MOU relative to adherence to this plan.

1.1.5.7.5. Establish research priorities for captive panthers which can be applied to management of the free-ranging population. Investigations could include such topics as vaccination protocols, baseline reproductive physiology, assisted reproduction technologies, and appropriate diseases.

1.1.5.7.6. Incorporate interpretative education at public facilities where captive panthers are held and prepare public information materials. See 3.1.3.6. and 3.2.7.

Expansion into South-Central Florida

1.2. Provide for the expansion of the breeding population of panthers in south Florida into south-central Florida. The potential for the persistence of the existing population in south Florida can be enhanced by its expansion into south-central Florida.

Feasibility and Habitat Identification

1.2.1. Continue to evaluate the potential for habitat in south-central Florida to support a breeding population. Evaluate the quantity and quality of existing panther habitat; likely future habitat trends with respect to human population growth; and patterns of public land ownership, highway expansions, and changing land use practices.

Facilitating Natural Population Expansion

1.2.2. If there is potential for habitat in south-central Florida to support a breeding population, determine if there are management steps that can be taken to facilitate natural expansion of female panthers into south-central Florida.

Translocation

1.2.3. If natural expansion of female panthers into south-central Florida is not likely, evaluate the feasibility of translocation to establish a breeding population, including an EA or EIS under the NEPA process if necessary.

1.2.4. If natural expansion is not likely, develop an expansion plan to guide translocation into south-central Florida. The plan should include education and outreach (implement actions in Section 3), consider the effects of translocations into south-central Florida on potential reintroductions elsewhere in the historic range, and consider the effects of translocations on the south Florida population.

Suitable Habitat

1.2.5. Secure, maintain, and restore suitable habitat for panthers that are dispersing into south-central Florida to support continued dispersal and settlement**.**

1.2.5.1. Secure a dispersal area north of Caloosahatchee River that maintains connection with habitat south of river.

1.2.5.2. Conserve lands buffering the Caloosahatchee River by fostering compatible land uses and riparian habitat protection directly along the river in order to maintain enough characteristics of panther habitat to allow dispersal northward and genetic exchange should female panthers be successfully established north of the river.

1.2.5.3. If establishment of a breeding population in south-central Florida is feasible, provide for the conservation and enhancement of other lands necessary for persistence of a population in south-central Florida.

1.2.6. Implement appropriate actions in Section 2.

1.2.6.1. If the population is expanded into south-central Florida, implement appropriate actions in Section 1.1.

Reintroduction

2. Within the historic range, identify, secure, maintain, and restore habitat in potential reintroduction areas and reestablish viable populations of the panther outside of south and south-central Florida.

Select Reintroduction Sites

2.1. Select reintroduction areas in cooperation / coordination with the southeastern States within the historic range of the panther. Use top three sites identified by Thatcher et al. (2006b) as a starting point.

2.1.1. **In cooperation / coordination with the southeastern States select potential reintroduction areas to be evaluated.**

2.1.2. **Develop and conduct preliminary public scoping to allow effective preplanning of the NEPA process.** This could include the use of focus / stakeholder meetings and opinion and attitude surveys in the Southeast and will build on knowledge gained from previous feasibility studies.

2.1.3. **Identify State and Federal laws, regulations, or policies that could conflict with reintroduction and resolve any potential conflicts** such as predator control policies that conflict with reintroduction.

2.1.4. **Conduct field surveys of selected reintroduction areas.** These evaluations should address habitat quality variables including prey density, available habitat types, distribution, connectivity, topography and understory vegetation for stalking and denning cover, hydroperiods and potential for inundation, future trends in land use, accessibility to humans, and recreational uses.

2.1.5. **Determine if puma are present in selected reintroduction areas** in the Southeast in order to understand any possible conflicts with reintroduction goals. This will be done by checking for sign of existing puma, identifying potential conflicts related to captive puma, and collecting and analyzing genetic samples from suspected wild puma encountered to determine their point-of-origin, if needed.

2.1.6. **Evaluate possible disease and parasite problems in selected reintroduction areas prior to releasing panthers.** Implement actions under 1.1.5.4.

2.1.7. **Consider contaminant issues when evaluating selected reintroduction areas.** Implement actions under 1.1.5.5.

2.1.8. **Use the NEPA process to develop and refine the appropriate reintroduction alternatives and recommend the preferred alternative (e.g., number of sites)**.

2.1.8.1. **Coordinate with the southeastern States, stakeholders, and the public for reintroduction site selection.**

2.1.8.2. **Collect, compare, and analyze sociopolitical data** (including public attitudes / opinions regarding panthers, predators, risks, and support) for identified potential reintroduction areas to help formulate and choose among alternatives.

2.1.8.3. **Using the information obtained in 2.1.8.1 and 2.1.8.2. use the NEPA process to develop and refine appropriate reintroduction alternatives and recommend the preferred alternative**.

Reintroduce Panthers into Suitable Sites

2.2. Reestablish viable populations outside of south and south-central Florida within the historic range when a suitable reintroduction site is selected.

Source of Panthers for Reintroduction

2.2.1. Determine the number of panthers from each age and sex class that are needed for a reintroduction program.

2.2.2. Evaluate removal of panthers from the wild.

2.2.2.1. Select individual panthers that could be removed for reintroduction without negatively affecting the persistence of the existing population. Removal of individuals cannot jeopardize the panther pursuant to section 7 of the ESA. Create a mechanism to expedite genetic analysis of all panthers genetically sampled to provide data for prudent and timely decision-making. Review of this data should occur annually relative to reintroduction decisions. Use a PVA model to evaluate the affect of translocation on the existing population.

2.2.2.2. Develop a protocol for translocation of panthers from the wild.

2.2.3. Evaluate the need for and establish, if necessary, a captive breeding program. This program would be to produce individuals for reintroduction.

2.2.4. Evaluate the role of alternative breeding strategies and / or source populations, including artificial insemination and surrogate mothers or puma outside of Florida that could provide a source of panthers.

Reintroduction Incentives

2.2.5. Identify and provide incentives and remove disincentives to Federal, State, and local governments and agencies to participate in reintroduction.

2.2.5.1. Identify and provide incentives to Federal, State, and local governments and agencies to participate in reintroduction.

2.2.5.2. Address the legal liability issues for State participation in a reintroduction program. Identify the existing State laws and immunities and obtain a state solicitor's opinion regarding liability, if needed.

2.2.5.3. Provide resources to assist with reintroduction.

Human Dimensions of Reintroduction

2.2.6. Address human dimensions of reintroduction (including conflicts between stakeholders and panthers) with education, incentives, compensation, and regulatory mechanisms. Social issues include landowner rights, safety for pets and livestock, effects on deer populations, and human safety. Implement actions under Section 3.

2.2.6.1. Develop and implement a protocol and response plan for handling human-panther interactions. Use existing protocols, including the draft Interagency Florida Panther Response Plan being prepared by FWC, NPS, and FWS.

2.2.6.2. Evaluate the need for and, if appropriate, designate experimental populations. Under section 10(j) of the ESA, FWS can designate reintroduced populations established outside the species' current range but within its historical range as "experimental." Designation of a population as experimental increases flexibility and discretion in managing reintroduced listed species.

2.2.6.3. Develop a compensation program for the depredation of livestock in reintroduction areas. An effective compensation program should have two components: proactive measures to prevent or reduce conflict between livestock and panthers, and a method for compensating livestock owners after a confirmed depredation by a panther. Programs established by other States and entities, such as Defenders of Wildlife, could be referenced for guidelines.

2.2.6.3.1. Develop and distribute a landowner, land manager, and lessees panther handbook. The handbook should include recommendations designed to minimize potential problems.

2.2.6.3.2. Provide assistance to landowners, land managers, and lessees to identify and address potential conflicts on their property.

2.2.6.3.3. Develop and implement a compensation program. Minimize procedural requirements for compensation when payment is warranted (once depredation by a panther has been determined and landowner protective efforts have been demonstrated). Partner with stakeholders to determine who receives compensation. Ensure that all individuals are adequately trained in confirming panther depredation.

2.2.6.4. Address concerns of hunters in reintroduction areas.

2.2.6.4.1. Understand hunting pressure and methods in potential reintroduction areas to identify possible conflicts, including a real or perceived decline in deer populations.

2.2.6.4.2. Partner with hunters and hunting lease holders, including timber companies, to address panther, hunter, and prey issues.

Release of Panthers

2.2.7. Develop a protocol and release panthers into selected reintroduction sites.

Monitoring Reintroduced Panthers

2.2.8. Develop and implement monitoring plans for the selected reintroduction areas.

2.2.9. Minimize and monitor illegal killing.

2.2.9.1. Enforce existing Federal and State laws and regulations regarding illegal killing.

2.2.9.2. Extend ESA "similarity of appearance" protection to puma in applicable portions of the historic range prior to reintroduction. Section 4(e) of the ESA and implementing regulations (50 CFR 17.50–17.52), authorize the treatment of an unlisted species as endangered or threatened if the species so closely resembles in appearance a listed endangered or threatened species that law enforcement personnel would have substantial difficulty in attempting to differentiate between the listed and unlisted species.

2.2.9.3. Implement a toll free telephone tip number in reintroduction areas as reintroduction is attempted and provide rewards to those that report illegal killing of panthers. Coordinate with existing State programs to avoid duplication.

Actions Once Populations Are Established

2.3. As additional populations are established, implement appropriate actions in Section 1.

Public Awareness and Education

3. Facilitate panther conservation and recovery through public awareness and education. Build support for the recovery effort through education and outreach programs that increase public understanding of panther behavior and recovery needs.

Design and Develop Materials and Programs

3.1. Design and develop education and outreach materials and programs.

Education Working Group

3.1.1. Form a working group to design and develop education and outreach materials and programs. The group should include social scientists, environmental educators, university academics, conservation organizations, county extension agents, agencies involved in panther recovery, other local groups and community leaders. Organizations can link together in various ways to bring unified, educational, public relations messages to groups of people concerned with panther conservation and recovery.

Social Science Research

3.1.2. Conduct social science research to identify public attitudes, knowledge levels, and concerns about panthers and panther recovery efforts. Draw on expertise of university academics, environmental educators, and social scientists.

3.1.2.1. Identify target audiences, content, strategic messages, and methods of getting the message out using social science research. Existing social science research on panthers and other carnivores such as wolves and bears can also be used. Audiences can include hunt clubs, hunters, outdoor enthusiasts, area landowners, livestock organizations, area leaders, and groups that attract women and minorities (Cramer 1995).

Production of Materials and Programs

3.1.3. Produce necessary materials and programs for public awareness and education.

Natural History, Recovery, and Reduction of Threats to Panthers

3.1.3.1. Produce information on natural history, place in the ecosystem, panther facts, benefits of recovery, and ways to reduce threats to panthers and their habitat. These materials should be produced in English and Spanish**.** This can include concepts such as umbrella species, predator-prey relationships, food web dynamics, cultural importance, only population of pumas remaining in the eastern U.S., historic and current range, attempts at eradication that led to original population declines, timeline of events in panther history, and biology and behavior.

Habitat Conservation and Management

3.1.3.2. Produce materials and programs regarding panther habitat conservation and management.

3.1.3.2.1. Compile information and produce materials and programs on landowner incentives. See Action 1.1.1.1. for information on incentives and ways to increase economic revenue for private lands.

3.1.3.2.2. Identify ecotourism values and economic incentives related to panthers and develop materials for ecotourism programs.

3.1.3.2.3. Compile information on land management techniques.

3.1.3.2.4. Develop a panther habitat management handbook for public and private land managers based on the best management practices produced under Action 1.1.3.1. Evaluate whether separate handbooks are needed for public and private land managers.

South Florida Population

3.1.3.3. Produce materials and programs regarding the south Florida population and its management.

3.1.3.3.1. Develop materials to inform the public and decision makers about methods for reducing panther-vehicle collisions, including the success of wildlife crossings, crossing design standards, road placement, and speed and volume of traffic. Use existing materials and programs, such as those produced by conservation organizations, wherever appropriate.

Human / Panther Interactions

3.1.3.4. Produce materials and programs regarding human / panther interactions.

3.1.3.4.1. Develop educational material to address human social issues related to panther conservation and recovery. These could include: human safety, safety for pets and livestock, landowner rights, and effects on deer populations. Identify appropriate individuals to distribute information. This can be a mass media campaign including TV, billboards, mailings, and presentations to homeowner groups similar to the FWC Bear Aware education and outreach program.

3.1.3.4.2. Develop a Living With Panthers outreach program. Inform stakeholders about panthers and ways to reduce potential conflicts. Implement this program statewide, especially where panthers live and disperse. Use the media, hunting license sales, pamphlets, signs, and other outlets. Model programs on other successful "living with wildlife" efforts such as the FWC Bear Aware program. Address topics such as biology and behavior of panthers, human-panther interactions, factors that affect interactions, how to reduce the likelihood of interactions, protecting pets and livestock, tips for recreation in panther country, and what to do if you encounter a panther.

3.1.3.4.3. **Develop materials and programs to address hunting concerns, such as a real or perceived decline in the deer population.** Draw on organizations experienced with hunting issues, such as the Quality Deer Management Association.

3.1.3.4.4. **Include panther conservation issues in ORV educational materials**. Materials should include regulations and reasons for staying on designated trails. Utilize U.S. Forest Service education and outreach program for ORV use in National Forests.

Population Expansion and Reintroduction

3.1.3.5. **Produce materials and programs regarding population expansion and reintroduction.**

3.1.3.5.1. **Examine sociological information, such as public attitudes in and around reintroduction sites.**

3.1.3.5.2. **Develop a media plan**. This process calls for oversight of logistical, public affairs, and biological aspects of a situation. Public affairs staff will be able to predict what would happen with reintroduction and plan public affairs events, coordinate logistics with other team members, and hold practice sessions of media relations activities. The process also includes regular briefings of staff on key topics and incorporates an assessment of the information needs of mass media news organizations and a media plan for release of panthers (for example see Jacobson 1999:301).

Displays and Programs in Public Environmental Education Centers

3.1.3.6. **Design education displays and programs for public environmental education centers, such as zoos and natural history museums.** Partners can also include the AZA and other affiliated organizations. Use existing programs such as the Panther Glades exhibit at Caribbean Gardens in Naples, Florida, as an example.

Programs and Materials for School Children

3.1.3.7. Develop education programs and materials for school children. This can include curriculum, participation in panther education and recovery actions, and panther awareness events.

3.1.3.8. Develop materials to promote Florida Panther Day.

Provide Materials and Programs

3.2. Provide materials and programs. Provide information to local planning organizations, decision makers and elected officials, the public, major landowners living in and adjacent to panther habitat, potential new residents and the realtor community, and other audiences as identified by social science research. Include positive proactive programs to keep people interested, involved, and a part of conservation and recovery programs. Programs can be also geared toward achieving voluntary behavior changes as an alternative to restrictions.

Communications Teams

3.2.1. Form communication teams to give presentations to audiences in and adjacent to panther habitat and in selected reintroduction sites.

Media / Public Relations Training for Agency Personnel

3.2.2. Provide media / public relations training for agency personnel who will be on-the-ground and interfacing with the public (including private landowners) and media. This includes staff and law enforcement officers. This can be provided in a workshop and a 5 - 10 page manual.

Distribute Materials and Provide Programs

3.2.3. Distribute materials and information to the public, landowners, and stakeholders.

3.2.3.1. Distribute information on landowner incentives.

3.2.3.2. Provide existing ecotourism facilities and the Visit Florida tourism promotion program with updated information on panthers that they can include in their programs. Ecotourism facilities in south Florida include boat tours, swamp buggy rides, and minibus tours.

3.2.3.3. Distribute information on land management techniques and provide technical assistance to public and private land managers regarding techniques to maintain and increase the value of habitat to panthers and their prey.

3.2.3.4. Inform the public, landowners, and decision makers about the needs and benefits of invasive species control / management and prescribed fire. Identify and work with existing programs that address invasive species control / management and the value of prescribed fire to panthers and their prey.

3.2.3.5. Distribute information on prey management techniques (including exotic game) on public and private lands.

3.2.3.6. Distribute materials to promote Florida Panther Day. This could include the media, schools, environmental education facilities, and others.

South Florida Population

3.2.4. Provide materials and programs regarding the south Florida panther population and its management.

3.2.4.1. Provide information on genetic restoration. This should be directed at clearing up misinformation about genetic restoration as well as informing the public about the benefits and potential needs for genetic restoration. Include historical information on *Puma* subspecies, how the plan was formulated and implemented, and results of the program.

3.2.4.2. Provide information on panther conservation issues in ORV educational materials.

3.2.4.3. Educate sportsmen groups and the public about the legal consequences of illegal harassment. This includes the need for recognizing harassment activities, the detrimental effects that may result from harassment (physical injury, physiological stress, reduced litter size, morbidity), and the importance of preventing actions that constitute harassment.

3.2.4.4. Provide information on panther management, including monitoring.

Human / Panther Interactions

3.2.5. Provide materials and programs regarding human / panther interactions.

3.2.5.1. Provide education and outreach to residents living in and adjacent to panther habitat. Include the realtor community. Include tips for living in panther habitat.

3.2.5.2. Provide tips for recreating in panther habitat.

3.2.5.3. Provide information on protecting livestock and pets. Outreach efforts need to reassure livestock owners that the chance of their livestock being taken by a panther can be minimized, and if it does happen, they may be compensated through a depredation fund.

3.2.5.4. Provide outreach materials to address hunting concerns. Include information regarding the effects of panthers on hunted prey species and hunting success. Provide information to hunters and hunt clubs. Use results from social science research.

Population Expansion and Reintroduction

3.2.6. Provide materials and programs regarding population expansion and reintroduction.

3.2.6.1. Engage and provide materials to landowners and the public in south-central Florida to build support for restoring and maintaining habitat and for expansion and reintroduction.

3.2.6.2. Target education at reintroduction sites to address social issues in advance of releasing panthers. Opinion surveys and conservation education should be the cornerstone of reintroduction.

3.2.6.3. Continue education and outreach efforts after panthers are released into a reintroduction site. Include regular contacts with area residents / landowners about the program. Continually reinforce and address panther conservation messages, especially as problems arise.

3.2.6.4. Identify existing ecotourism facilities and State ecotourism boards in or near selected reintroduction sites and provide them with updated panther information. Information can be provided on an on-going basis in a format that is simple for the facilities to include in their programs.

Displays and Programs in Public Environmental Education Centers

3.2.7. Identify and work with existing environmental education facilities to provide or enhance panther education displays and programs. This includes Jacksonville Zoo, Lowry Park Zoo, the Tallahassee Museum, Caribbean Gardens, and Busch Gardens.

Programs and Materials for School Children

3.2.8. Distribute education programs and materials to school children.

Evaluation

3.3. Evaluate outreach and educational materials and programs. Monitor the programs as they are implemented. Evaluate education and outreach efforts, especially to assess changes in human behavior and attitude. A good example of program evaluation is the FWC Bear Aware *Black Bear Public Education Program.* Evaluation data should be compared to preliminary social science research (pre-program measurement) to provide a post-program measurement.

3.4. Revise materials where evaluation indicates a need.

V. IMPLEMENTATION SCHEDULE

The Implementation Schedule that follows outlines actions and estimated costs for the recovery program for the Florida panther, as set forth in this recovery plan. It is a guide for meeting the recovery goal and criteria outlined in this plan. This schedule indicates action priorities, action numbers, action descriptions, duration of actions, the parties potentially responsible for actions (either funding or carrying out), and estimated costs. Parties believed to have authority or responsibility for implementing a specific recovery action are identified in the Implementation Schedule. When more than one party has been identified, the proposed lead party is indicated by an asterisk (*). The listing of a party in the Implementation Schedule does not require the identified party to implement the action(s) or to secure funding for implementing the action(s).

Priority Number

Priority 1 - An action that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.

Priority 2 - An action that must be taken to prevent a significant decline in species population, habitat quality, or some other significant negative impact short of extinction.

Priority 3 - All other actions necessary to provide for full recovery of the species.

Work on or completion of priority 1, 2, or 3 actions may take place concurrently.

EXHIBIT 22

Participants and Other Parties Referenced in the Implementation Schedule

COE	U.S. Army Corps of Engineers
counties	South Florida counties
DCA	Department of Community Affairs
EPA	Environmental Protection Agency
FDACS	Florida Department of Agriculture and Consumer Services
FDEP	Florida Department of Environmental Protection
FDOF	Florida Division of Forestry
FDOT	Florida Department of Transportation
FHP	Florida Highway Patrol
FHwA	Federal Highway Administration
FNAI	Florida Natural Areas Inventory
FWC	Florida Fish and Wildlife Conservation Commission
FWS	U.S. Fish and Wildlife Service
IFAS	Institute of Food and Agricultural Science
local governments	City and county agencies
NGO	Non-governmental organization
NPS	National Park Service
NRCS	Natural Resources Conservation Service
private	Private industry, landowners, etc.
State agencies	State natural resource agencies
Tribes	Miccosukee Tribe of Indians of Florida and Seminole Tribe of Florida
universities	Public and private universities
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USGS	U.S. Geological Survey
WMD	Water Management Districts located in south Florida

EXHIBIT 22

Florida Panther Recovery Plan Implementation Schedule										
Priority	Action Number	Recovery Action Description	Action Duration	Participants	Estimated Fiscal Year Costs ($000s)					Comments
					FY1	FY2	FY3	FY4	FY5	
Existing Population										
South Florida Habitat										
Non-Regulatory Incentive Programs										
3	1.1.1.1.1.	Develop Safe Harbor Agreements	Continuous	FWS*, private						Cost included in standard operating budget of Federal agency.
3	1.1.1.1.2.	Focus available incentive programs to restore and enhance habitat	Continuous	FWS*, FWC*, NRCS, NGO, FDOF, IFAS, counties, private	60	60	60	60	60	Cost included in standard operating budgets of agencies.
3	1.1.1.1.3.	Explore the creation of new panther conservation incentive programs	3 years	FDEP, FWC, FWS, NRCS, counties, local governments, NGO, private	10	10	10			
1	1.1.1.1.4.1.	Revise and implement the preliminary project proposal developed for expansion of FPNWR	10 years	FWS*						Cost dependent upon land prices.
3	1.1.1.1.4.2.	Modify existing land appraisal procedures	5 years	Local governments	10	10	10	10	10	
3	1.1.1.1.4.3.	Conduct an annual review of Florida Forever projects and rate them with respect to panther conservation values	Continuous	FWC*, FWS, NPS, NGO	1.5	1.5	1.5	1.5	1.5	
1	1.1.1.1.5.	Identify and support local initiatives to protect habitat and purchase development rights	Continuous	FWS, FWC, counties, local governments	10	10	10	10	10	
Regulatory Programs										
2	1.1.1.2.1.	Create a Federal / State working group to	< 1 year	FWS, FWC, FDEP, COE,						Cost included in standard operating budgets of

EXHIBIT 22

Florida Panther Recovery Plan Implementation Schedule										
Priority	Action Number	Recovery Action Description	Action Duration	Participants	Estimated Fiscal Year Costs ($000s)					Comments
					FY1	FY2	FY3	FY4	FY5	
		coordinate permit review and consultation		EPA, NRCS, FDOF, WMD, NPS, FDOT, FHwA, USFS, local governments						agencies.
2	1.1.1.2.2.	Track permits, especially incidental take and compensation received, issued through Federal and State regulatory programs	Continuous	FWS*, FWC, FDEP, COE, EPA, NRCS, FDOF, WMD, NPS, FDOT, FHwA, USFS	5	5	5	5	5	Cost included in standard operating budgets of agencies. Much of the information is available, but needs interagency coordination.
2	1.1.1.2.3.1.	Ensure that panther conservation and protection of habitat is included in the State Clearinghouse (SAI) reviews of Federal activities	Continuous	FWC*, FDEP						Cost included in standard operating budgets of agencies.
1	1.1.1.2.3.2.	Ensure that the section 7 consultation process is utilized and that the best available science is used in development of biological opinions	Continuous	FWS*, COE, EPA, NPS, FHwA, NRCS, USFS						Cost included in standard operating budgets of agencies.
2	1.1.1.2.3.3.	Avoid adverse effects to habitat (including prey) attributable to CERP and other water management projects	10 years	FWS*, COE, FDEP, FWC, NPS, WMD, FDOF	200	200	200	200	200	Cost for identifying effects is included in standard operating budgets of agencies. Additional funds are needed for monitoring.
2	1.1.1.2.4.1.	Provide review and recommendations to FDEP,	Continuous	FWC*, FDEP, WMD						Cost included in standard operating budgets of

EXHIBIT 22

Florida Panther Recovery Plan Implementation Schedule										
Priority	Action Number	Recovery Action Description	Action Duration	Participants	Estimated Fiscal Year Costs ($000s)					Comments
					FY1	FY2	FY3	FY4	FY5	
		Department of Community Affairs, WMDs, and other State agencies on permit applications that can potentially impact habitat								agencies.
2	1.1.1.2.4.2.	Work with counties and municipalities to modify and amend Comprehensive Plans to include the goal of no net loss of quantity, quality, or functionality of habitat in Primary, Secondary, and Dispersal Zones	Continuous	FWC*, FDEP, counties, local governments						Cost included in standard operating budgets of agencies.
1	1.1.1.2.4.3.	Develop a mechanism for providing compensation for projects that affect small acreages (e.g., single family residences) of habitat	2 years	FWS*, FWC, COE, local governments	10	10				
2	1.1.1.2.4.4.	Initiate and encourage landscape level HCPs where proposed non-Federal actions or projects will impact panthers or their habitat	Continuous	FWS*, FWC, counties, private, local governments, NGO						Cost included in standard operating budgets of agencies.
	Habitat Fragmentation, Connectivity, and Spatial Extent									
1	1.1.1.3.1.1.	Quantitatively assess factors that define dispersal corridors and use least-cost pathways analysis to identify potential habitat corridors	2-3 years	FWC*, NPS, FWS, USGS, universities	30	30	30			
1	1.1.1.3.1.2.	Restore habitat in potential corridors identified by	Continuous	FWC*, FWS*, FDEP*, NGO,						Cost dependent upon number of willing

EXHIBIT 22

Florida Panther Recovery Plan Implementation Schedule										
Priority	Action Number	Recovery Action Description	Action Duration	Participants	Estimated Fiscal Year Costs ($000s)					Comments
					FY1	FY2	FY3	FY4	FY5	
		least-cost pathways analysis		private, FDOF, WMD, local government						landowners.
1	1.1.1.3.1.3.1.	Secure the Dispersal Zone	Continuous	FWC*, FWS, FDEP*, NGO, private, FDOF, WMD, local government						Cost dependent upon number of willing landowners and land prices.
1	1.1.1.3.1.3.2.	Secure Camp Keais Strand	Continuous	FWC*, FWS, FDEP*, NGO, private, FDOF, WMD, local government						Cost dependent upon number of willing landowners and land prices.
1	1.1.1.3.1.3.3.	Secure a corridor between BCNP and Okaloacoochee Slough	Continuous	FWC*, FWS*, FDEP*, NPS, NGO, private, FDOF, WMD, local government						Cost dependent upon number of willing landowners and land prices.
2	1.1.1.3.1.3.4.	Consider maintenance of habitat corridors for panthers during Everglades restoration to avoid isolation of the ENP subpopulation	30 years	FWS*, COE, FDEP, FWC, NPS, WMD	5	5	5	5	5	
1	1.1.1.3.2.	Maintain spatial extent and arrangement	Continuous	FWC*, FWS, NPS, NGO, NRCS, FDEP*, FDOF, WMD, private, counties, local governments						Cost dependent upon land prices.
	Negative Impacts of Roads on Panther Habitat – South Florida									
2	1.1.1.4.1.	Ensure that panther habitat	Continuous	FWS, FWC,	10	10	10	10	10	

EXHIBIT 22

Florida Panther Recovery Plan Implementation Schedule										
Priority	Action Number	Recovery Action Description	Action Duration	Participants	Estimated Fiscal Year Costs ($000s)					Comments
					FY1	FY2	FY3	FY4	FY5	
		needs are incorporated in the planning of new roads and road expansion projects.		FDOT, FHwA, counties, local government, NGO, COE, FDEP, DCA						
1	1.1.1.4.2.	Identify current and planned roads that could affect panthers, eliminate roads where possible, and retrofit priority areas with crossings and fencing as appropriate to promote connectivity and dispersal	Continuous	FWS*, FWC, NPS, FDOT, FHwA, counties, local government, NGO, COE, FDEP, DCA	15	15	15	15	15	Cost to retrofit priority areas will be site-specific.
1	1.1.1.4.3.	Secure habitat adjacent or contiguous to areas of high risk for panther-vehicle collisions	Continuous	FDEP*, FWS, FWC*, NPS, FDOT, FHwA, counties, local government, NGO, COE, DCA						Cost will be site-specific.
3	1.1.1.4.4.	Determine the impacts of roads on range expansion and dispersal	3 years	FWC*, NPS, FWS, universities, USGS	50	50	50			
Habitat Restoration in Primary, Secondary, and Dispersal Zones										
3	1.1.2.1.	Identify and prioritize tracts suitable for restoration	3 years	FWC*, NRCS, USGS, FNAI, universities, FWS	50	50	50			
2	1.1.2.2.	Provide incentives and mechanisms for restoration of agricultural and range lands	Continuous	NRCS, FWC, FWS, FDEP, FDACS	30	30	30			Costs to be determined for remaining years.
2	1.1.2.3.	Develop / expand funding	Continuous	NRCS, FWC,	30	30	10	10	10	

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Florida Panther Recovery Plan Implementation Schedule										
Priority	Action Number	Recovery Action Description	Action Duration	Participants	Estimated Fiscal Year Costs ($000s) FY1	FY2	FY3	FY4	FY5	Comments
		mechanisms and other incentives for habitat restoration		FWS, FDEP, NGO, private						
3	1.1.2.4.1.	Facilitate and conduct habitat restoration research	10 years	FWC*, NRCS, USGS, FWS, universities, NGO	200	200	200	200	200	
3	1.1.2.4.2.	Monitor and evaluate restoration projects	Continuous	FWC, NRCS, USGS, FWS, universities, NGO	30	30	30	30	30	
Habitat Management – South Florida										
2	1.1.3.1.	Develop, disseminate, and implement best management practices for managing habitat	2 years	FWS, FWC, NPS, NRCS, FDEP, FDOF, counties, local governments	25	25				Much of the information needed is available but needs interagency coordination.
Public Land Management – South Florida										
2	1.1.3.2.1.	Formalize a network of south Florida public land managers	< 1 year	FWS*, FWC, NPS, FDEP, FDOF, WMD, counties, local governments						Cost included in standard operating budgets of agencies.
2	1.1.3.2.2.	Prepare, review, and implement habitat management plans for public lands	Continuous	FWS, FWC, NPS, FDEP, FDOF, WMD, counties, local governments	100	100	100	100	100	
2	1.1.3.2.3.	Track habitat management activities and their effects on panthers	Continuous	FWC*, FWS, NPS, FDEP, FDOF, FNAI, WMD, counties, local governments	30	30	30	30	30	

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Florida Panther Recovery Plan Implementation Schedule										
Priority	Action Number	Recovery Action Description	Action Duration	Participants	Estimated Fiscal Year Costs ($000s)					Comments
					FY1	FY2	FY3	FY4	FY5	
Private Land Management – South Florida										
2	1.1.3.3.1.	Provide incentives and assistance to willing landowners	Continuous	FWS, FWC, NRCS, FDOF, IFAS, counties, private, NGO	60	60	60	60	60	
1	1.1.3.3.2.	Provide incentives and work with landowners to encourage them not to convert their lands to less suitable habitat	Continuous	FWS, FWC, NRCS, IFAS, FDOF, counties, private, NGO						Costs will be site-specific.
3	1.1.3.3.3.	Review and comment on county stewardship plans	Periodic	FWS*, FWC, NRCS, FDEP counties, private, NGO						Cost included in standard operating budgets of agencies.
Monitoring Habitat – South Florida										
2	1.1.4.1.	Quantify 24-hour habitat use and movement patterns	3 years	FWC*, NPS	450	450	450			
2	1.1.4.2.	Update Kautz et al. (2006) maps every five years	Periodic	FWS, FWC, USGS, universities	60					
South Florida Population										
Demographics										
2	1.1.5.1.1.	Convene a group of agency and independent experts to conduct an appropriate PVA	2 years	FWS*, FWC, NPS, USGS, universities	30	30				
1	1.1.5.1.2.	Continue to determine and monitor demographic variables	Continuous	FWC*, NPS, FWS	750	750	750	750	750	
2	1.1.5.1.3.	Develop and implement annual capture and monitoring work plans	Continuous	FWC*, NPS, FWS						Costs included in item 1.1.6.1.2.

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Florida Panther Recovery Plan Implementation Schedule										
Priority	Action Number	Recovery Action Description	Action Duration	Participants	Estimated Fiscal Year Costs ($000s)					Comments
					FY1	FY2	FY3	FY4	FY5	
	Genetic Diversity									
1	1.1.5.2.1.	Continue to monitor physical and physiological characteristics correlated with inbreeding and depletion of genetic variability	Continuous	FWC*, NPS, FWS						Costs included in item 1.1.6.1.2.
1	1.1.5.2.2.	Develop and implement a genetics management plan	Continuous	FWS*, FWC, NPS, universities, private	30	30				Costs for remaining years to be determined.
2	1.1.5.2.3.	Develop a population model to predict future genetic consequences of management proposals and actions	3 years	FWS, FWC, NPS, USGS, universities	50	50	50			
	Harassment, Injury, and Mortality									
2	1.1.5.3.1.1.	Identify harassment activities	Continuous	FWS, FWC, NPS	10	10	10	10	10	
2	1.1.5.3.1.2.1.	Manage public access to minimize harassment opportunities	Continuous	FWS, FWC, NPS, FDEP, WMD, FDOF, counties, local governments	1	1	1	1	1	
3	1.1.5.3.1.2.2.	Develop ORV management plans where ORVs are allowed	Periodic	FWS, FWC, NPS, FDEP, WMD, FDOF, counties, local governments	10	10	10	10	10	
3	1.1.5.3.1.2.3.	Enforce regulations and statutes regarding discharge of firearms, explosive devices, or other loud noise sources	Continuous	FWS, FWC, NPS, FDEP, WMD, FDOF, counties, local governments	1	1	1	1	1	Cost included in standard operating budgets of agencies.

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Florida Panther Recovery Plan Implementation Schedule										
Priority	Action Number	Recovery Action Description	Action Duration	Participants	Estimated Fiscal Year Costs ($000s)					Comments
					FY1	FY2	FY3	FY4	FY5	
3	1.1.5.3.1.3.1.	Post and maintain regulatory and informational signs	Continuous	FWS, FWC, NPS, FDEP, WMD, FDOF, counties, local governments	15	15	15	15	15	
2	1.1.5.3.1.3.2.	Enforce existing laws and regulations	Continuous	FWS, FWC, NPS, FDEP, WMD, FDOF, counties, local governments						Cost included in standard operating budgets of agencies.
2	1.1.5.3.2.	Enforce existing Federal and State laws and regulations to minimize and prevent illegal killing	Continuous	FWS, FWC, NPS, FDEP, WMD, FDOF						Cost included in standard operating budgets of agencies.
2	1.1.5.3.3.1.1.	Convene a working group to prioritize and address actions needed in panther-vehicle collision areas	2-3 years	FWS, FWC, NPS, FDOT, counties, NGO, private						Cost included in standard operating budgets of agencies and groups.
2	1.1.5.3.3.1.2.	Secure funding for and install wildlife crossings and fencing in high risk areas	Continuous	FDOT*, FWS, FWC, NPS, counties, NGO, FHwA, private						Costs will be site-specific.
2	1.1.5.3.3.1.3.	Evaluate and implement other mechanisms to prevent mortalities on roads	Continuous	FWC*, FDOT, FWS, NPS, FHwA, counties, NGO, private						Cost depends on mechanism and site.
2	1.1.5.3.3.2.	Build mechanisms into permits for road projects to provide for adaptive management for panther mortality and / or other unforeseen problems	Continuous	FWC*, FWS, FDOT, COE, FHwA						Cost included in standard operating budgets of agencies.
2	1.1.5.3.3.3.	Develop new strategies to	Continuous	FDOT, FWS,						Cost depends upon

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Florida Panther Recovery Plan Implementation Schedule										
Priority	Action Number	Recovery Action Description	Action Duration	Participants	Estimated Fiscal Year Costs ($000s)					Comments
					FY1	FY2	FY3	FY4	FY5	
		prevent road mortalities or injuries		FWC, NPS, counties, NGO, private						technology.
3	1.1.5.3.3.4.	Enforce existing speed zones, monitor effectiveness, and modify as needed	Continuous	FHP, counties, FWC, FWS, NPS						Cost included in standard operating budgets of agencies.
3	1.1.5.3.4.1.	Provide adequate resources and facilities for rehabilitation of panthers that might be injured or orphaned during capture and monitoring efforts	Continuous	FWS, FWC, NPS, NGO, private						Cost depends in part upon individual operating costs for each facility.
3	1.1.5.3.4.2.	Develop, implement, review, and revise protocols (i.e., research, monitoring, capture, handling) as needed to minimize risks to panthers	Continuous	FWC*, NPS, FWS						Cost included in standard operating budgets of agencies.
Diseases and Parasites										
3	1.1.5.4.1.1.	Continuously evaluate the value of specific vaccinations and review all vaccination protocols annually	Continuous	FWC*, NPS, FWS						Cost included in standard operating budgets of agencies.
1	1.1.5.4.1.2.	Revise vaccination protocols as appropriate considering new disease threats as they arise	As needed	FWC*, NPS, FWS						Cost depends on threat, included in standard operating budgets of agencies.
1	1.1.5.4.2.1.	Collect appropriate tissue and blood samples from all panthers handled, both live and dead, and analyze them for the presence of priority	Continuous	FWC*, NPS, FWS	60	60	60	60	60	

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Florida Panther Recovery Plan Implementation Schedule										
Priority	Action Number	Recovery Action Description	Action Duration	Participants	Estimated Fiscal Year Costs ($000s)					Comments
					FY1	FY2	FY3	FY4	FY5	
		diseases and parasites								
2	1.1.5.4.2.2.	Evaluate the disease threats presented by other species including bobcats and domestic cats and identify any needed management intervention	3 years	FWC, NPS, FWS, USGS, universities	60	60	60			
1	1.1.5.4.2.3.	Implement appropriate management strategies for disease and parasite monitoring and control	As needed	FWC, NPS, FWS						Case-specific costs.
	Environmental Contaminants									
3	1.1.5.5.1.	Produce a summary report and database of contaminants in panthers and their environment in south Florida	2 years	FWS, FWC, EPA, FDEP, universities	30	30				
2	1.1.5.5.2.	Continue to monitor contaminants, especially mercury and endocrine disruptors, in panthers and their prey	Continuous	FWC, NPS, FWS						Cost included in standard operating budgets of agencies.
2	1.1.5.5.3.	Implement actions necessary to remediate contaminants in high risk areas	As needed	EPA, FDEP, FWS, NPS, COE, FWC, FDACS, FDOF, FDOT, counties, local governments						Cost will be site-specific.
	Prey Base									
2	1.1.5.6.1.1.	Assess and monitor the status of deer populations in panther habitat	Continuous	FWC, FWS, NPS, FWS, Tribes, FDOF, FDEP, WMD	70	70	70	70	70	

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Florida Panther Recovery Plan Implementation Schedule										
Priority	Action Number	Recovery Action Description	Action Duration	Participants	Estimated Fiscal Year Costs ($000s)					Comments
					FY1	FY2	FY3	FY4	FY5	
3	1.1.5.6.1.2.	Develop deer harvest regulations that do not compromise the panther prey base and take into consideration food requirements of the panther	Continuous	FWC, NPS, FWS, Tribes, FDOF, FDEP, WMD	5	5	5	5	5	
2	1.1.5.6.1.3.	Continue to monitor the impacts on panthers of hunting on public and private lands in panther habitat	Continuous	FWC*, NPS, FWS, Tribes, FDOF, FDEP, WMD	5	5	5	5	5	
2	1.1.5.6.2.	Encourage management / control of feral hog populations that does not threaten the panther	Continuous	FWC, NPS, FWS, Tribes, FDOF, WMD	20	20	20			Costs to be determined for remaining years.
3	1.1.5.6.3.1.	Continue statewide monitoring for chronic wasting disease and other emerging wildlife and domestic animal diseases and implement available eradication or control methods	Continuous	FWC, FWS, NPS, USDA, FDACS	117	117	117	117	117	
3	1.1.5.6.3.2.	Identify, map, and appropriately monitor and regulate exotic animal operations that could serve as a source of infection for wild populations	Continuous	FWC, USDA, FDACS, FWS	75	75	75	75	75	
3	1.1.5.6.3.3.	Coordinate with the southeastern States to review protocols and regulations that require imported ungulates to be	Continuous	FWS, USDA, State agencies	2	2	2	2	2	

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Florida Panther Recovery Plan Implementation Schedule										
Priority	Action Number	Recovery Action Description	Action Duration	Participants	Estimated Fiscal Year Costs ($000s) FY1	FY2	FY3	FY4	FY5	Comments
		disease-free								
Captive Management										
2	1.1.5.7.1.	Develop guidance for the removal of panthers from the wild	1-2 years	FWC, FWS, NPS, NGO, universities	10	10				
3	1.1.5.7.2.	Evaluate the need for and establish, if necessary, a captive breeding program	As needed / Continuous	FWS, FWC, NPS, private						Costs to be determined.
3	1.1.5.7.3.	Evaluate the role of alternative breeding strategies	As needed / Continuous	FWS, FWC, NPS, private						Cost included in item 1.1.7.7.4.2.
3	1.1.5.7.4.1.	Form a captive management working group	< 1 yr	FWS, FWC, NPS, private						Cost included in standard operating budgets of agencies.
3	1.1.5.7.4.2.	Develop a captive management plan	1-2 years	FWS, FWC, NPS, private	10	10				
3	1.1.5.7.4.3.	Implement the captive management plan	As needed / Continuous	FWS, FWC, NPS, private						Costs to be determined.
3	1.1.5.7.5.	Establish research priorities for captive panthers which can be applied to management of the free-ranging population	1 year	FWS, FWC, NPS, private						Cost included in item 1.1.7.7.4.2.
3	1.1.5.7.6.	Incorporate interpretative education at public facilities where captive panthers are held and prepare public information materials	2 years	NGO*, Private, FWS, FWC, NPS, universities	30	30				
Expansion into South-Central Florida										
Feasibility and Habitat Identification										
2	1.2.1.	Continue to evaluate the potential for habitat in south-central Florida to	1 year	FWS, USGS, universities	50					

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Florida Panther Recovery Plan Implementation Schedule										
Priority	Action Number	Recovery Action Description	Action Duration	Participants	Estimated Fiscal Year Costs ($000s) FY1	FY2	FY3	FY4	FY5	Comments
		support a breeding population								
Facilitating Natural Population Expansion										
2	1.2.2.	If there is potential for habitat in south-central Florida to support a breeding population, determine if there are management steps that can be taken to facilitate natural expansion of female panthers into south-central Florida	1 year	FWC, FWS						Cost included in standard operating budgets of agencies.
Translocation										
3	1.2.3.	If natural expansion of female panthers into south-central Florida is not likely, evaluate the feasibility of translocation to establish a breeding population, including an EA or EIS under the NEPA process if necessary	3-5 years	FWS, FWC, NPS						Cost included in standard operating budgets of agencies.
3	1.2.4.	If natural expansion is not likely, develop an expansion plan to guide translocation into south-central Florida	1 year	FWS, FWC, NPS						Cost included in standard operating budgets of agencies.
Suitable Habitat										
2	1.2.5.1.	Secure a dispersal area north of Caloosahatchee River that maintains connection with habitat south of river	5 years	FWS, FWC, WMD, FDEP, FDOF, counties, private						Costs will be site-specific.

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Florida Panther Recovery Plan Implementation Schedule										
Priority	Action Number	Recovery Action Description	Action Duration	Participants	Estimated Fiscal Year Costs ($000s)					Comments
					FY1	FY2	FY3	FY4	FY5	
3	1.2.5.2.	Conserve lands buffering the Caloosahatchee River	Continuous	FWS, FWC, WMD, FDEP, FDOF, NGO, counties, private						Cost included in standard operating budgets of agencies.
3	1.2.5.3.	If establishment of a breeding population in south-central Florida is feasible, provide for the conservation and enhancement of other lands necessary for persistence of a population in south-central Florida	Continuous	FWS, FWC, WMD, FDEP, FDOF, NGO, counties, private						Costs will be site-specific.
3	1.2.6.1.	If the population is expanded into south-central Florida, implement appropriate actions in Section 1.1	Continuous	FWS, FWC, WMD, FDEP, FDOF, counties, private						Costs dependent upon actions needed.
Reintroduction										
Select Reintroduction Sites										
2	2.1.1.	In cooperation / coordination with the southeastern States select potential reintroduction areas to be evaluated	1-2 years	FWS, State agencies, USFS						Cost included in standard operating budgets of agencies.
2	2.1.2.	Develop and conduct preliminary public scoping to allow effective preplanning of the NEPA process	1-2 years	FWS, State agencies, USGS, USFS, universities	50	50				
3	2.1.3.	Identify State and Federal laws, regulations, or policies that could conflict	1-2 years	FWS*, State agencies, USGS, USFS,						Cost included in standard operating budgets of agencies.

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Florida Panther Recovery Plan Implementation Schedule										
Priority	Action Number	Recovery Action Description	Action Duration	Participants	Estimated Fiscal Year Costs ($000s)					Comments
					FY1	FY2	FY3	FY4	FY5	
		with reintroduction and resolve any potential conflicts		universities						
3	2.1.4.	Conduct field surveys of selected reintroduction areas	3 years	FWS*, State agencies, USGS, USFS, universities	100	100	100			
3	2.1.5.	Determine if puma are present in selected reintroduction areas	1-2 years	FWS*, State agencies, USGS, USFS, universities	40	40				
3	2.1.6.	Evaluate possible disease and parasite problems in selected reintroduction areas prior to releasing panthers	1-2 years	FWS*, State agencies, USGS, USFS, universities	30	30				
3	2.1.7.	Consider contaminant issues when evaluating selected reintroduction areas	1-2 years	FWS*, State agencies, USGS, USFS universities, EPA	30	30				
2	2.1.8.1.	Coordinate with the southeastern States, stakeholders, and the public for reintroduction site selection	2 years	FWS*, state agencies and local governments, USDA, USFS, universities, private, NGO						Cost included in standard operating budgets of agencies.
3	2.1.8.2.	Collect, compare, and analyze sociopolitical data	2 years	FWS*, State agencies and local governments, USGS, USFS, universities,	50	50				

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Florida Panther Recovery Plan Implementation Schedule										
Priority	Action Number	Recovery Action Description	Action Duration	Participants	Estimated Fiscal Year Costs ($000s) FY1	FY2	FY3	FY4	FY5	Comments
				NGO						
3	2.1.8.3.	Using the information obtained in 2.1.8.1 and 2.1.8.2. use the NEPA process to develop and refine appropriate reintroduction alternatives and recommend the preferred alternative	1-2 years	FWS*, State agencies, USFS, NGO						Cost included in standard operating budgets of agencies.
Reintroduce Panthers into Suitable Sites										
Source of Panthers for Reintroduction										
2	2.2.1.	Determine the number of panthers from each age and sex class that are needed for a reintroduction program	1 year	FWS*, FWC, State agencies and local governments, USGS, NPS universities	30					
2	2.2.2.1.	Select individual panthers that could be removed for reintroduction without negatively affecting the persistence of the existing population	1 year	FWS, FWC, NPS, USGS, universities						Cost included in standard operating budgets of agencies.
3	2.2.2.2.	Develop a protocol for translocation of panthers from the wild	1 year	FWS*, FWC, NPS, USGS, universities						Cost included in standard operating budgets of agencies.
3	2.2.3.	Evaluate the need for and establish, if necessary, a captive breeding program	1-2 years	FWS, FWC, NPS, private						Cost for evaluation included in standard operating budgets of agencies. Costs for establishment to be determined.
3	2.2.4.	Evaluate the role of	1 year	FWS, FWC,						Cost included in standard

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Florida Panther Recovery Plan Implementation Schedule										
Priority	Action Number	Recovery Action Description	Action Duration	Participants	Estimated Fiscal Year Costs ($000s)					Comments
					FY1	FY2	FY3	FY4	FY5	
		alternative breeding strategies and / or source populations		NPS, private						operating budgets of agencies.
Reintroduction Incentives										
2	2.2.5.1.	Identify and provide incentives to Federal, State, and local governments and agencies to participate in reintroduction	1-2 years	FWS, State agencies, local governments, county, USFS						Cost included in standard operating budgets of agencies.
3	2.2.5.2.	Address the legal liability issues for State participation in a reintroduction program	1 year	FWS, State agencies						Cost dependent on solution.
3	2.2.5.3.	Provide resources to assist with reintroduction	Continuous	FWS, State agencies, NGO, private						State / site-specific costs.
Human Dimensions of Reintroduction										
3	2.2.6.1.	Develop and implement a protocol and response plan for handling human-panther interactions	Continuous	FWS, State agencies, NGO, USFS, NPS	7	7	7	7	7	
3	2.2.6.2.	Evaluate the need for and, if appropriate, designate experimental nonessential populations	1-2 years	FWS						Cost included in standard operating budget of agency.
3	2.2.6.3.1.	Develop and distribute a landowner, land manager, and lessees panther handbook	2 years	FWS, State agencies, NGO, USDA, private, USFS, NPS	10	20				
3	2.2.6.3.2.	Provide assistance to landowners, land managers, and lessees to identify and address potential conflicts on their property	Continuous	FWS, State agencies, NGO, NRCS, private						Cost included in standard operating budgets of agencies.

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Florida Panther Recovery Plan Implementation Schedule										
	Action	Recovery Action	Action		Estimated Fiscal Year Costs ($000s)					
Priority	Number	Description	Duration	Participants	FY1	FY2	FY3	FY4	FY5	Comments
3	2.2.6.3.3.	Develop, fund, and implement a compensation program	Continuous	FWS, State agencies, NGO, USDA, private						State / site-specific costs.
3	2.2.6.4.1.	Understand hunting pressure and methods in potential reintroduction areas to identify possible conflicts, including a real or perceived decline in deer populations	2 years	FWS, State agencies, NGO, private	5	5				
3	2.2.6.4.2.	Partner with hunters and hunting lease holders, including timber companies, to address panther, hunter, and prey issues	Continuous	FWS, State agencies, NGO, USDA, private						State / site-specific costs.
Release of Panthers										
1	2.2.7.	Develop a protocol and release panthers into selected reintroduction sites	Continuous / As needed	FWS, State agencies, NGO, private, USGS, universities						State / site-specific costs.
Monitoring Reintroduced Panthers										
3	2.2.8.	Develop and implement monitoring plans for the selected reintroduction areas	Continuous	FWS, State agencies, USGS, USFS universities	100	100	100	100	100	
3	2.2.9.1.	Enforce existing Federal and State laws and regulations regarding illegal killing	Continuous	FWS, State agencies, USFS						Cost included in standard operating budgets of agencies.
3	2.2.9.2.	Extend ESA "similarity of appearance" protection to puma in applicable portions of the historic range prior to	2 years	FWS						Cost included in standard operating budget of agency.

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Florida Panther Recovery Plan Implementation Schedule										
Priority	Action Number	Recovery Action Description	Action Duration	Participants	Estimated Fiscal Year Costs ($000s)					Comments
					FY1	FY2	FY3	FY4	FY5	
		reintroduction								
3	2.2.9.3.	Implement a toll free telephone tip number in reintroduction areas	Continuous	FWS, State agencies	2	2	2	2	2	
Actions Once Populations Are Established										
3	2.3.	As additional populations are established, implement appropriate actions in Section 1	As needed							Duration, participants, and costs depend on actions as well as State / site selection.
Public Awareness and Education										
Design and Develop Materials and Programs										
Education Working Group										
2	3.1.1.	Form a working group to design and develop education and outreach materials and programs	Continuous	FWS*, FWC, NPS, USDA, NRCS, FDEP, FDOF, WMD, State agencies, NGO	10	10	10	10	10	
Social Science Research										
2	3.1.2.1.	Identify target audiences, content, strategic messages, and methods of getting the message out using social science research	1 year	FWS, FWC, NPS, USFS, NRCS, FDOF, WMD, State agencies, NGO	30					
Production of Materials and Programs										
Natural History, Recovery, and Reduction of Threats to Panthers										
3	3.1.3.1.	Produce information on natural history, place in the ecosystem, panther facts, benefits of recovery, and ways to reduce threats to panthers and their habitat	Continuous	FWS, FWC, FDEP, NPS, NRCS, FDOF, USFS, WMD, NGO, State agencies, counties, local governments,	50	50	50	50	50	

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Florida Panther Recovery Plan Implementation Schedule										
Priority	Action Number	Recovery Action Description	Action Duration	Participants	Estimated Fiscal Year Costs ($000s)					Comments
					FY1	FY2	FY3	FY4	FY5	
				universities, private						
Habitat Conservation and Management										
3	3.1.3.2.1.	Compile information and produce materials and programs on landowner incentives	Continuous	FWS, FWC, FDEP, NPS, NRCS, FDOF, USFS, WMD, NGO, State agencies, counties, local governments, universities, private	10	10	10	10	10	
3	3.1.3.2.2.	Identify ecotourism values and economic incentives related to panthers and develop materials for ecotourism programs	1-2 years	FWS, State agencies, NGO, private, universities	25					
3	3.1.3.2.3.	Compile information on land management techniques	1-2 years	FWS, FWC, NRCS, FDEP, FDOF, WMD, NGO	30	30				
3	3.1.3.2.4.	Develop a panther habitat management handbook for public and private land managers based on the best management practices	1-2 years	FWS, FWC, NRCS, FDEP, FDOF, WMD, NGO						Costs included in 3.1.3.2.3.
South Florida Population										
3	3.1.3.3.1.	Develop materials to inform the public and decision makers about methods for reducing panther-vehicle collisions	Continuous	FWS, FWC, NPS, USDA, NRCS, FDOF, WMD, State agencies, NGO						Costs included in 3.1.3.1.
Human / Panther Interactions										

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Florida Panther Recovery Plan Implementation Schedule										
	Action	Recovery Action	Action		Estimated Fiscal Year Costs ($000s)					
Priority	Number	Description	Duration	Participants	FY1	FY2	FY3	FY4	FY5	Comments
3	3.1.3.4.1.	Develop educational material to address human social issues related to panther conservation and recovery	Continuous	FWS, FWC, FDEP, NPS, NRCS, FDOF, USFS, WMD, NGO, State agencies, counties, local governments, universities, private	20	20	20	20	20	
2	3.1.3.4.2.	Develop a Living With Panthers outreach program	1 year	FWS, FWC, NPS, Tribes, NRCS, NGO, State agencies	15					
3	3.1.3.4.3.	Develop materials and programs to address hunting concerns, such as a real or perceived decline in the deer population	2-3 years	FWS, FWC, NPS, USGS, universities, State agencies, NGO	10	10	10			
3	3.1.3.4.4.	Include panther conservation issues in ORV educational materials	Continuous	FWS, FWC, NPS, USFS, NRCS, FDOF, WMD, State agencies, NGO	1	1	1	1	1	
Population Expansion and Reintroduction										
2	3.1.3.5.1.	Examine sociological information, such as public attitudes in and around reintroduction sites	2-3 years	FWS, USGS, universities, State agencies, NGO	30	30	30			
2	3.1.3.5.2.	Develop a media plan	1 year	FWS, FWC, NPS, Tribes, NGO, State agencies	100					
Displays and Programs in Public Environmental Education Centers										

EXHIBIT 22

Florida Panther Recovery Plan Implementation Schedule										
Priority	Action Number	Recovery Action Description	Action Duration	Participants	Estimated Fiscal Year Costs ($000s)					Comments
					FY1	FY2	FY3	FY4	FY5	
3	3.1.3.6.	Design education displays and programs for public environmental education centers, such as zoos and natural history museums	Continuous	FWS, FWC, NPS, Tribes, NGO, State agencies, private	50	5	5	5	5	
Programs and Materials for School Children										
3	3.1.3.7.	Develop education programs and materials for school children	1 year	FWS, FWC, NPS, Tribes, NGO, State agencies, private	100					
3	3.1.3.8.	Develop materials to promote Florida Panther Day	1 year	FWC*, NPS, FWS, NGO, State agencies, private	30					
Provide Materials and Programs										
Communications Teams										
3	3.2.1.	Form communication teams to give presentations to audiences in and adjacent to panther habitat and in selected reintroduction sites	Continuous	FWS, FWC, NPS, USFS, NRCS, FDEP, FDOF, WMD, State agencies, NGO	5	5	5	5	5	
Media / Public Relations Training for Agency Personnel										
2	3.2.2.	Provide media / public relations training for agency personnel who will be on-the-ground and interfacing with the public (including private landowners) and media	Continuous	NRCS, FWS, FWC, NPS, NRCS, Tribes, NGO, State agencies, private	5	5	5	5	5	
Distribute Materials and Provide Programs										
3	3.2.3.1.	Distribute information on landowner incentives	Continuous	FWS, FWC, FDEP, NPS,						Costs included in 3.2.3.3.

EXHIBIT 22

Florida Panther Recovery Plan Implementation Schedule										
Priority	Action Number	Recovery Action Description	Action Duration	Participants	Estimated Fiscal Year Costs ($000s)					Comments
					FY1	FY2	FY3	FY4	FY5	
				NRCS, FDOF, USFS, WMD, NGO, State agencies, counties, local governments, universities, private						
3	3.2.3.2.	Provide existing ecotourism facilities and the Visit Florida tourism promotion program with updated information on panthers	Continuous	NPS, FWS, FWC, Tribes, private, NGO	7	5	5	5	5	
2	3.2.3.3.	Distribute information on land management techniques and provide technical assistance to public and private land managers regarding techniques to maintain and increase the value of habitat to panthers and their prey	Continuous	FWS, FWC, NRCS, FDEP, FDOF, WMD, NGO	300	300	300	300	300	
3	3.2.3.4.	Inform the public, landowners, and decision makers about the needs and benefits of invasive species control / management and prescribed fire	Continuous	FWS, FWC, NPS, USDA, NRCS, FDEP, counties, NGO, DCA, IFAS, USFS						Costs included in standard operating budgets of agencies.
3	3.2.3.5.	Distribute information on prey management techniques (including exotic game) on public and private lands	Continuous	FWS, FWC, NPS, USDA, NRCS, FDEP, FDOF, WMD, State agencies, counties, local						Costs included in standard operating budgets of agencies. Costs included in 3.2.3.3.

EXHIBIT 22

Florida Panther Recovery Plan Implementation Schedule										
Priority	Action Number	Recovery Action Description	Action Duration	Participants	Estimated Fiscal Year Costs ($000s)					Comments
					FY1	FY2	FY3	FY4	FY5	
				governments, NGO						
3	3.2.3.6.	Distribute materials to promote Florida Panther Day	Continuous	FWC*, NPS, FWS, NGO, State agencies	10	10	10	10	10	
	South Florida Population									
3	3.2.4.1.	Provide information on genetic restoration	Continuous	FWS, FWC, NPS, NGO, private						Costs included in 3.1.3.1.
3	3.2.4.2.	Provide information on panther conservation issues in ORV educational materials	Continuous	FWS, FWC, NPS, USFS, NRCS, FDOF, WMD, State agencies, NGO						Costs included in 3.1.3.1.
3	3.2.4.3.	Educate sportsmen groups and the public about the legal consequences of illegal harassment	Continuous	FWS, FWC, NPS, USDA, NRCS, FDOF, WMD, State agencies, NGO						Costs included in 3.1.3.1.
3	3.2.4.4.	Provide information on panther management, including monitoring	Continuous	FWC, FWS, NPS, USDA, NRCS, FDOF, State agencies, NGO						Costs included in 3.1.3.1.
	Human / Panther Interactions									
2	3.2.5.1.	Provide education and outreach to residents living in and adjacent to panther habitat	Continuous	FWS, FWC, NPS, USDA, NRCS, FDOF, WMD, State agencies, NGO	50	50	50	50	50	
3	3.2.5.2.	Provide tips for recreating in panther habitat	Continuous	FWS, FWC, NPS, USFS, NRCS, FDEP, FDOF, WMD,						Cost included in 3.2.5.1.

EXHIBIT 22

Florida Panther Recovery Plan Implementation Schedule										
Priority	Action Number	Recovery Action Description	Action Duration	Participants	Estimated Fiscal Year Costs ($000s)					Comments
					FY1	FY2	FY3	FY4	FY5	
				State agencies, NGO						
3	3.2.5.3.	Provide information on protecting livestock and pets	Continuous	FWS, FWC, NPS, USFS, NRCS, FDOF, WMD, State agencies, NGO						Cost included in 3.2.5.1.
3	3.2.5.4.	Provide outreach materials to address hunting concerns	Continuous	FWS, FWC, NPS, USDA, NRCS, FDOF, WMD, State agencies, NGO						Cost included in 3.2.5.1.
Population Expansion and Reintroduction										
2	3.2.6.1.	Engage and provide materials to landowners and the public in south-central Florida to build support for restoring and maintaining habitat and for expansion and reintroductions	Continuous	FWS, FWC, NRCS, FDOF, WMD, counties, NGO						Costs included in 3.2.3.3.
2	3.2.6.2.	Target education at reintroduction sites to address social issues in advance of releasing panthers	Continuous	FWS, State agencies, NRCS, USFS, NGO, private	50	50	50	50	50	
3	3.2.6.3.	Continue education and outreach efforts after panthers are released into a reintroduction site	Continuous	FWS, State agencies, NRCS, USFS, NGO, private						Cost included in 3.2.6.2.
3	3.2.6.4.	Identify existing ecotourism facilities and State ecotourism boards in or near selected reintroduction sites and provide them with	Continuous	FWS, State agencies, private, NGO						Costs included in 3.2.3.2.

EXHIBIT 22

Florida Panther Recovery Plan Implementation Schedule										
Priority	Action Number	Recovery Action Description	Action Duration	Participants	Estimated Fiscal Year Costs ($000s) FY1	FY2	FY3	FY4	FY5	Comments
		updated panther information								
	Displays and Programs in Public Environmental Education Centers									
3	3.2.7.	Identify and work with existing environmental education facilities to provide or enhance panther education displays and programs	Continuous	NPS, FWS, FWC, FDEP, Tribes, private, NGO	50	50	50	50	50	
	Programs and Materials for School Children									
3	3.2.8.	Distribute education programs and materials to school children	Continuous	FWS, FWC, NPS, Tribes, NGO, State agencies, private	20	20	20	20	20	
Evaluation										
3	3.3.	Evaluate outreach and educational materials and programs	Continuous	FWS, FWC, NPS, Tribes, NGO, State agencies	15	15	15	15	15	
3	3.4	Revise materials where evaluation indicates a need	Continuous	FWS, FWC, NPS, Tribes, NGO, State agencies	150	150	150	150	150	

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EXHIBIT 22

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EXHIBIT 22

FIGURES

EXHIBIT 22

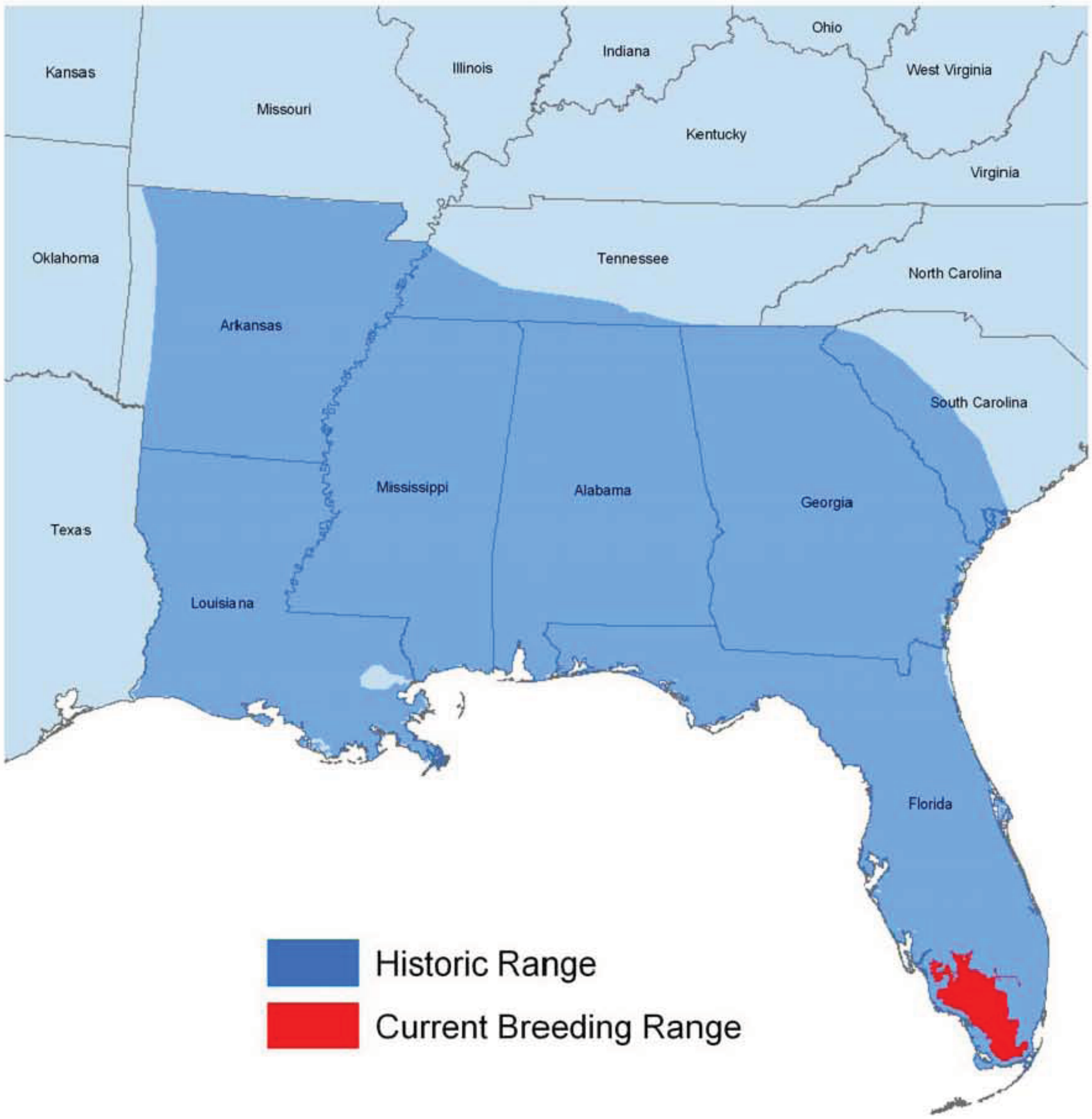

Figure 1. Historic and current range of the Florida panther.

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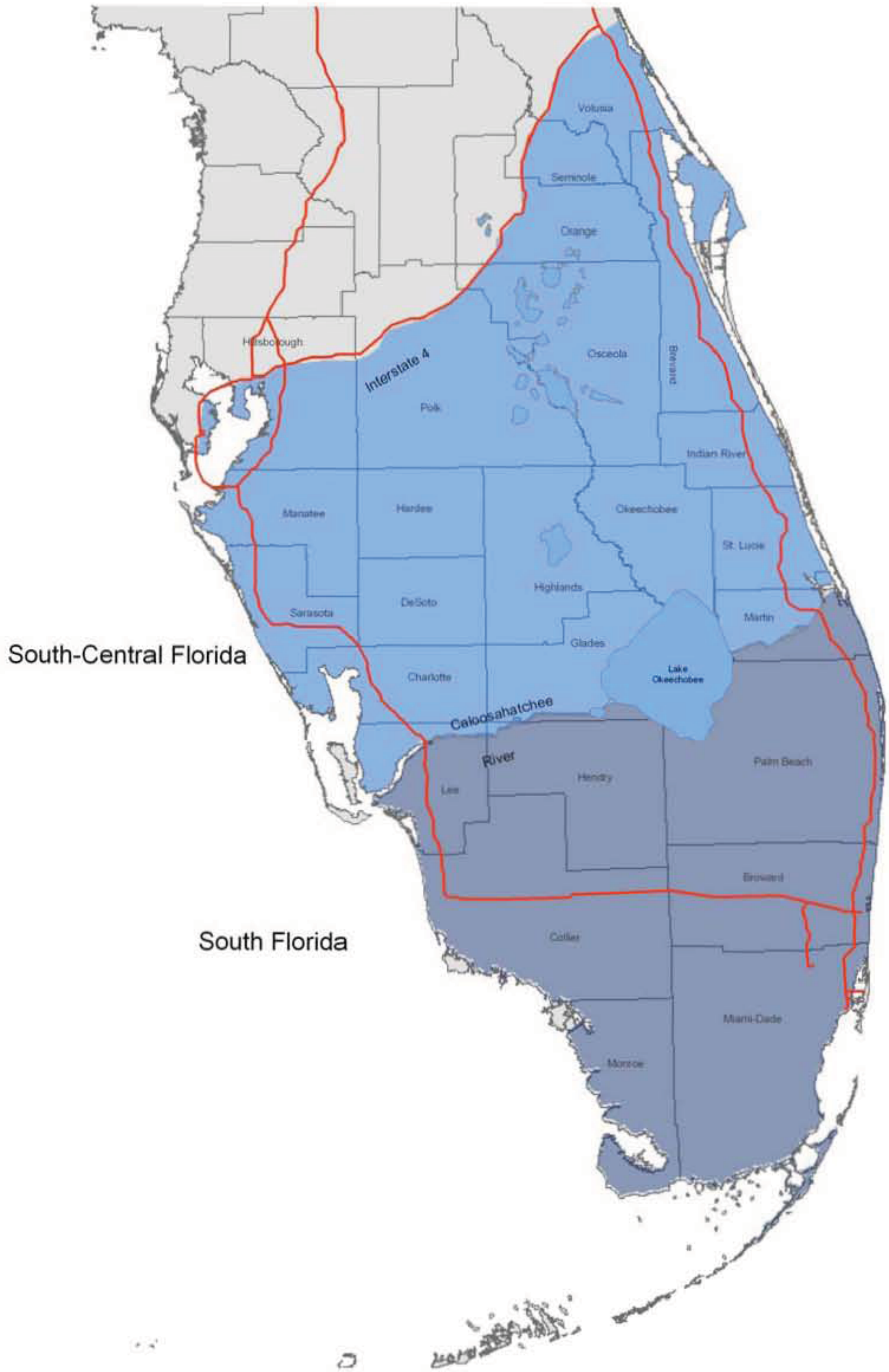

Figure 2. Delineation between south and south-central Florida.

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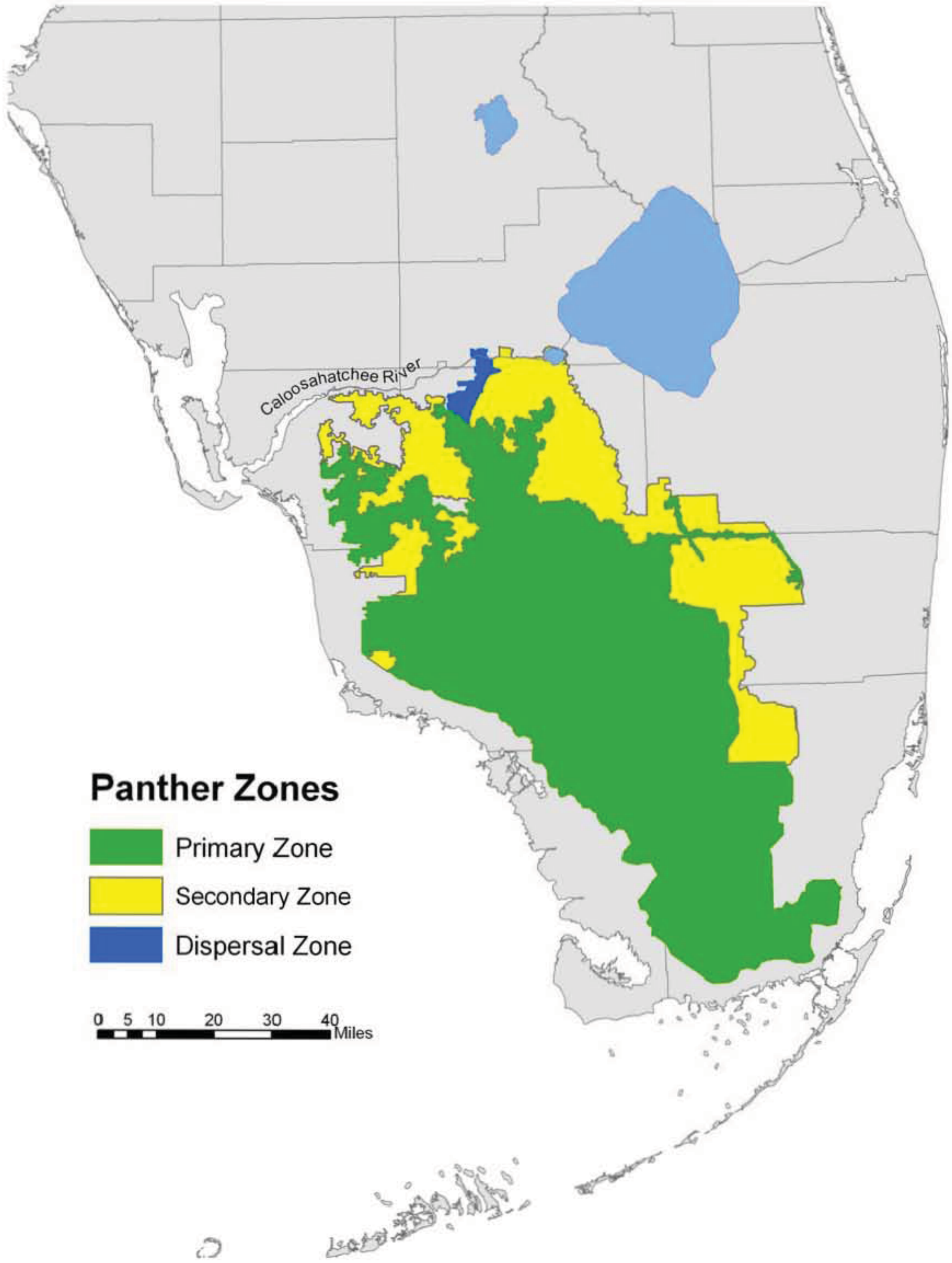

Figure 3. Florida panther zones in south Florida (Kautz et al. 2006).

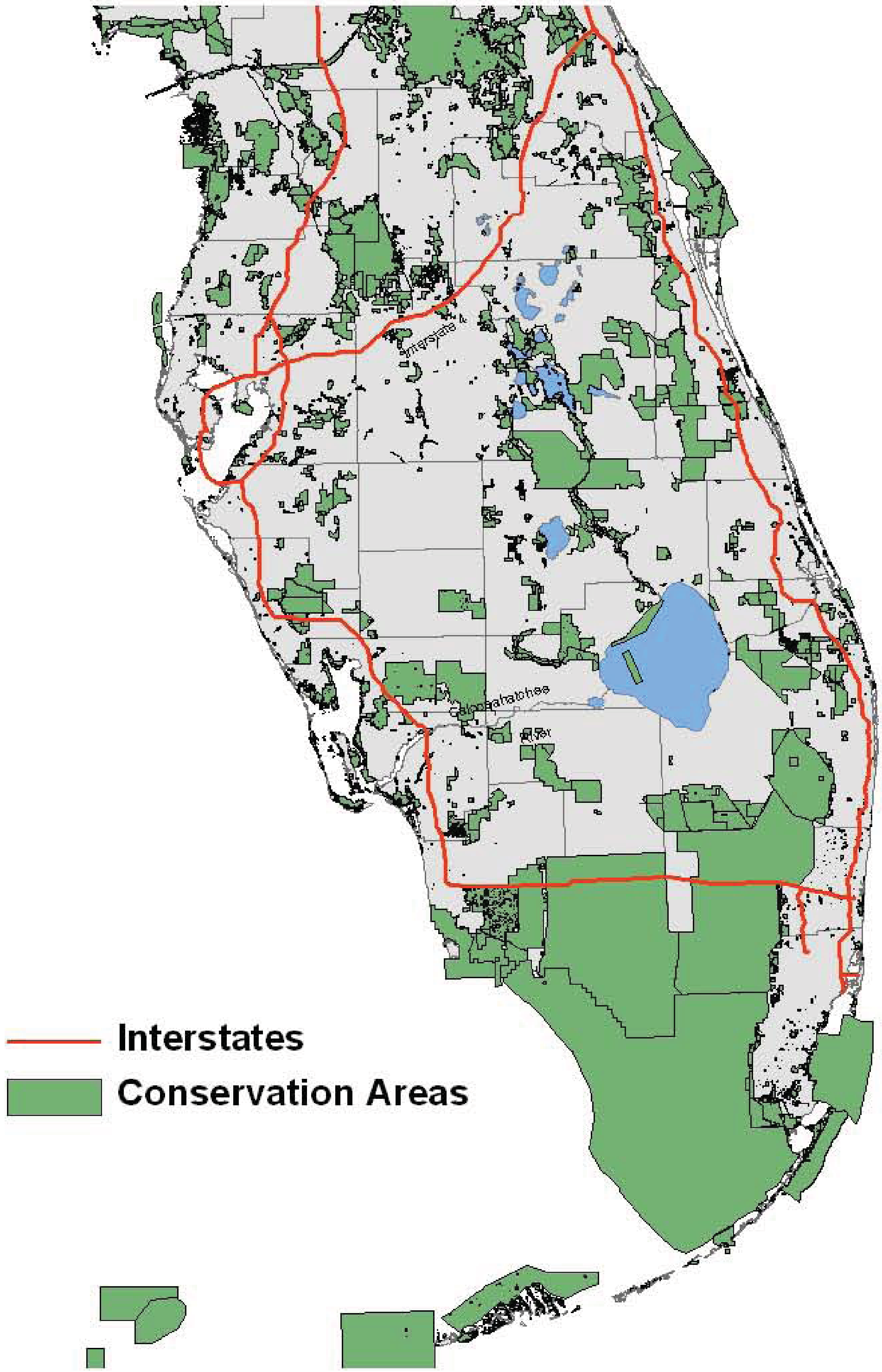

Figure 4. Conservation areas of south and south-central Florida.

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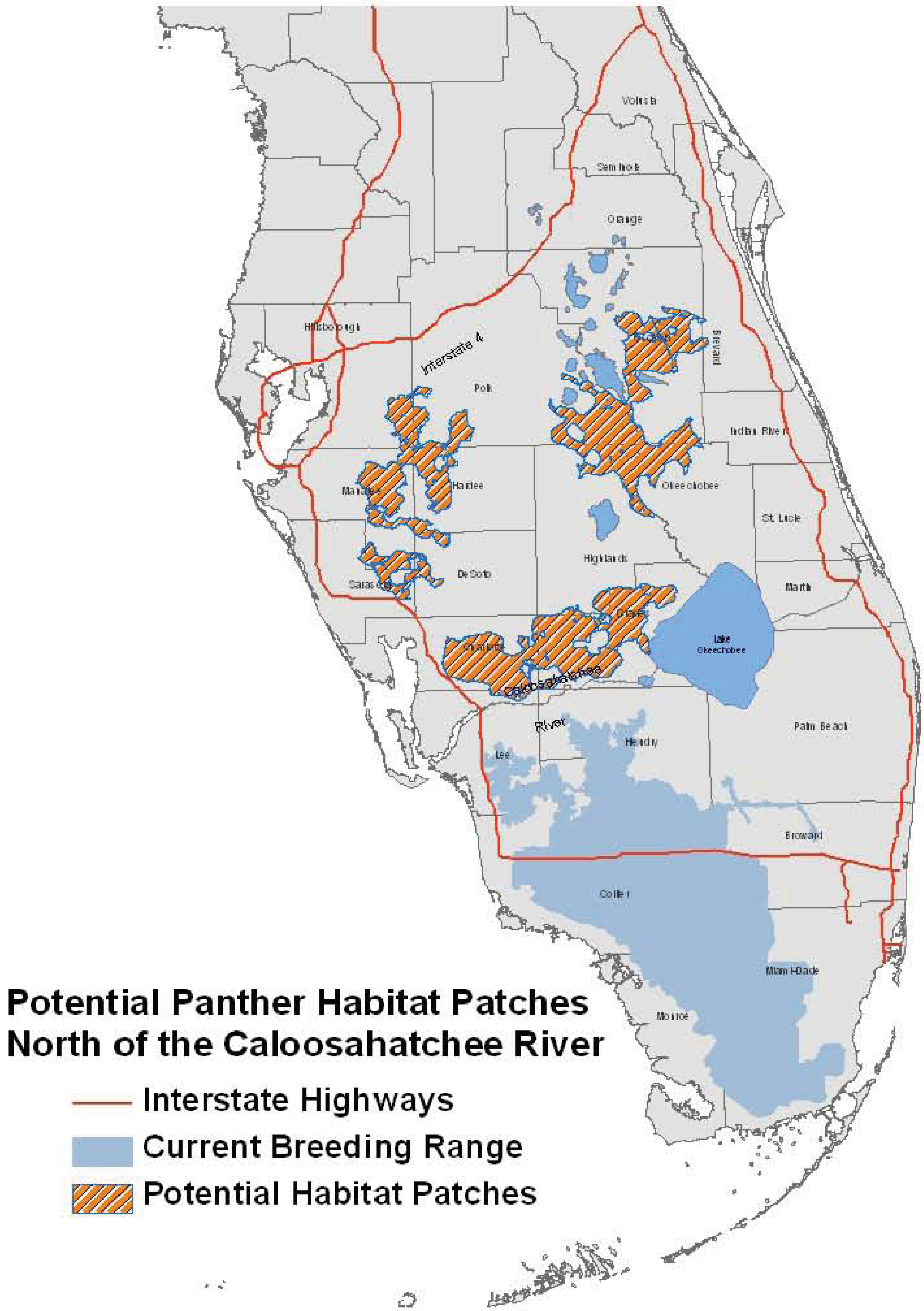

Figure 5. Potential panther habitat patches identified by Thatcher et al. (2006a).

APPENDIX A. DEFINITIONS

ALLEE EFFECTS – Inverse density dependence; for smaller populations, the reproduction and survival of individuals decrease; reproduction, finding a mate in particular, may be increasingly difficult as the population density decreases.

EFFECTIVE POPULATION SIZE (N_e) – A theoretical population with a 1:1 sex ratio that would result in the same amount of inbreeding or genetic drift as the actual population. Denoted as N_e, the effective population size is usually less than the actual population size.

ENDANGERED – Any species which is in danger of extinction throughout all or a significant portion of its range.

HABITAT – The physical space within which an animal lives. The various factors commonly recognized as components of habitat – cover, food, water, and such – are contained within this area. Panther habitat includes all areas required for the panther to live out its full life-cycle, including areas providing food and shelter and supporting characteristic movement such as hunting, breeding, dispersal, and territorial behavior.

INBREEDING (individual) – The mating of related individuals (e.g., brother-sister, father-daughter, mother-son).

INBREEDING (population) – A population in which matings occur between relatives at a frequency greater than expected by chance.

INBREEDING DEPRESSION – Reduction in reproduction, survival, or other fitness characters due to inbreeding.

INTROGRESSION – The incorporation of genes of one subspecies into the gene pool of another.

LEAST-COST PATHWAYS ANALYSES – a modeling method to measure effective distance between habitat patches and connectivity between existing or potential reserves. Maps routes of least resistance or travel cost between habitat patches.

METAPOPULATION – Two or more partially isolated populations, called subpopulations, which are linked by dispersal events.

PHILOPATRY – The tendency of an individual to return to or stay in its home area. Female panthers tend to be more philopatric than males.

POLYGYNOUS – A pattern of mating in which a male has more than one female partner.

EXHIBIT 22

<u>POPULATION</u> – A group of interbreeding individuals living in the same geographic area at the same time and sharing a common gene pool.

<u>SELF-SUSTAINING POPULATION</u> – A population that is able to sustain itself independently.

<u>SPATIAL CONFIGURATION</u> – Refers to how patches of habitat are arranged on the landscape with respect to one another as well as their degree of connectivity and relative land cover composition. An extensive arrangement of contiguous tracts of land that incorporates connectivity to support panther life history needs (e.g., appropriate cover, spatial extent, landscape configuration, prey densities, mating access, dispersal routes, minimizing human disturbance).

<u>SPECIES</u> (ESA definition) – includes any subspecies of fish or wildlife or plants, and any distinct population segment of any species or vertebrate fish or wildlife which interbreeds when mature.

<u>SUBPOPULATION</u> – Each distinct population in a metapopulation.

<u>THREATENED</u> – Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

<u>VIABLE</u> – A viable species is one that can reasonably be expected to avoid extinction over a long period of time. Viability is the ability of a population or species to persist over time. A viable panther population is considered to have a 95% probability of persistence for 100 years.

EXHIBIT 22

APPENDIX B. THREATS ANALYSIS USING THE FIVE LISTING FACTORS

SOUTH FLORIDA

Factor A: The present or threatened destruction, modification, or curtailment of the Florida panther's habitat or range.

	Stress																				
	Loss of ability for natural expansion of range				Habitat destruction				Habitat fragmentation				Population isolation & lack of connectivity				Habitat degradation				
	Severity	Scope	Stress rank		Severity	Scope	Stress rank		Severity	Scope	Stress rank		Severity	Scope	Stress rank		Severity	Scope	Stress rank		
	V	V	Very high		V	H	High		V	H	High		H	H	High		H	M	Medium		
Source of stress	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	**Factor A overall threat rank**
Transportation projects	H	H	H	Very high	L	V	M	Medium	V	V	V	High	M	V	H	High	-	-	-	-	Very high
Lack of suitable habitat	V	H	V	Very high	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Very high
Water management & conversion to water (includes CERP)	-	-	-	-	M	H	M	Medium	M	V	H	High	M	V	H	High	L	M	L	Low	High
Residential development	-	-	-	-	V	V	V	High	H	V	H	High	-	-	-	-	-	-	-	-	High
Inadequate habitat patch size	-	-	-	-	-	-	-	-	-	-	-	-	M	V	H	High	-	-	-	-	High
Mining and mineral exploration	-	-	-	-	L	V	M	Medium	L	V	M	Medium	-	-	-	-	L	L	L	Low	Medium
Conversion of habitat to agriculture	-	-	-	-	L	H	M	Medium	L	L	L	Low	-	-	-	-	M	H	M	Low	Medium

EXHIBIT 22

Factor A continued

	Stress																				
	Loss of ability for natural expansion of range				Habitat destruction				Habitat fragmentation				Population isolation & lack of connectivity				Habitat degradation				
	Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		
	V	V	Very high		V	H	High		V	H	High		H	H	High		H	M	Medium		
Source of stress	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	**Factor A overall threat rank**
Major ditches	-	-	-	-	-	-	-	-	L	V	M	Medium	-	-	-	-	-	-	-	-	Medium
Caloosahatchee River as a barrier	L	M	L	Medium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Medium
Intensification of agricultural uses	-	-	-	-	-	-	-	-	L	M	L	Low	-	-	-	-	L	H	M	Low	Low
Invasive exotic plant species	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	M	M	Low	Low
Lack of or poor habitat management	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	M	M	Low	Low

EXHIBIT 22

SOUTH FLORIDA

Factor B: Overutilization for commercial, recreational, scientific, or education purposes.

Source of stress	**Stress**				**Factor B overall threat rank**
	Overutilization for scientific purposes				
	Severity	Scope	**Stress rank**		
	L	L	Low		
	Contribution	Irreversibility	Rank	**Threat rank**	
Impacts of capture and monitoring	L	L	L	Low	Low

EXHIBIT 22

SOUTH FLORIDA

Factor C: Disease and predation.

	Stress				
	Disease				
	Severity	Scope	**Stress rank**		
	L	L	Low		
Source of stress	Contribution	Irreversibility	Rank	**Threat rank**	**Factor C overall threat rank**
Feline leukemia	M	L	M	Medium	Medium
All diseases	L	M	L	Low	Low

EXHIBIT 22

SOUTH FLORIDA

Factor D: The inadequacy of existing regulatory mechanisms.

The Recovery Team believed regulatory mechanisms were more appropriately considered as strategies underlying the other stresses and sources. Therefore, they chose not to evaluate Factor D.

EXHIBIT 22

SOUTH FLORIDA

Factor E: Other natural or manmade factors affecting the Florida panther's continued existence.

	Stress																				
	Panther mortality				Loss of genetic diversity				Decline of prey base				Genetic swamping				Loss/lack of support for panther conservation				
	Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		
	H	H	High		M	H	Medium		M	M	Medium		L	V	Low		L	V	Low		
Source of stress	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	**Factor E overall threat rank**
Intraspecific aggression	H	V	H	High	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	High
Mercury toxicity	L	V	M	Medium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Medium
Road kills	H	M	M	Medium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Medium
Illegal kills	L	H	M	Medium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Medium
Disease	L	H	M	Medium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Medium
Effect of small population size	-	-	-	-	V	M	H	Medium	-	-	-	-	-	-	-	-	-	-	-	-	Medium
Lack of suitable habitat	-	-	-	-	V	V	V	Medium	-	-	-	-	-	-	-	-	-	-	-	-	Medium
Lack of corridors for dispersal	-	-	-	-	M	H	M	Low	-	-	-	-	-	-	-	-	-	-	-	-	Low
Escape of captive pumas	-	-	-	-	-	-	-	-	-	-	-	-	L	H	M	Low	-	-	-	-	Low
Managed releases of pumas	-	-	-	-	-	-	-	-	-	-	-	-	M	M	M	Low	-	-	-	-	Low
Ungulate disease	-	-	-	-	-	-	-	-	L	H	M	Low	-	-	-	-	-	-	-	-	Low

EXHIBIT 22

Factor E continued

	Stress																				
	Panther mortality				Loss of genetic diversity				Decline of prey base				Genetic swamping				Loss/lack of support for panther conservation				
	Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		
	H	H	High		M	H	Medium		M	M	Medium		L	V	Low		L	V	Low		
Source of stress	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	**Factor E overall threat rank**
Water management or conversion to water	-	-	-	-	-	-	-	-	M	M	M	Low	-	-	-	-	-	-	-	-	Low
Natural climate or environmental change	-	-	-	-	-	-	-	-	L	V	M	Low	-	-	-	-	-	-	-	-	Low
Lack of or poor prey management (e.g, over hunting)	-	-	-	-	-	-		-	L	L	L	Low	-	-	-	-	-	-	-	-	Low
Prey habitat loss / degradation	-	-	-	-	-	-	-	-	M	H	M	Low	-	-	-	-	-	-	-	-	Low
Exotic prey management	-	-	-	-	-	-	-	-	L	L	L	Low	-	-	-	-	-	-	-	-	Low
Change in the legal description	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	V	H	V	Low	Low

EXHIBIT 22

Factor E continued

	Stress																				
	Panther mortality				Loss of genetic diversity				Decline of prey base				Genetic swamping				Loss/lack of support for panther conservation				
	Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		
	H	H	High		M	H	Medium		M	M	Medium		L	V	Low		L	V	Low		
Source of stress	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	**Factor E overall threat rank**
Public fear of panthers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	L	M	L	Low	Low
Landowner fear of regulation, lost property rights, and negative economic consequences	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	H	M	M	Low	Low

EXHIBIT 22

REINTRODUCTION

Factor A: The present or threatened destruction, modification, or curtailment of the Florida panther's habitat or range.

	Stress																				
	Unidentified potential habitat				Habitat fragmentation				Habitat destruction				Incompatible management of private lands				Incompatible management of public lands				
	Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		
	V	V	Very high		V	V	Very high		H	H	High		M	M	Medium		L	M	Low		
Source of stress	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	**Factor A overall threat rank**
Urbanization	-	-	-	-	M	V	H	Very high	M	V	H	High	-	-	-	-	-	-	-	-	Very high
Transportation projects	-	-	-	-	V	V	V	Very high	H	H	H	High	-	-	-	-	-	-	-	-	Very high
Low density residential development	-	-	-	-	V	H	V	Very high	V	H	V	High	-	-	-	-	-	-	-	-	Very high
Lack of land use planning	-	-	-	-	H	V	H	Very high	-	-	-	-	-	-	-	-	-	-	-	-	Very high
Inadequate evaluation of potential habitat in historic range	V	L	H	Very high	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Very high
Lack of prioritization system among areas	V	L	H	Very high	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Very high
Conversion of habitat to agriculture	-	-	-	-	M	M	M	High	M	M	M	Medium	-	-	-	-	-	-	-	-	High
Human recreational uses in panther habitat	-	-	-	-	M	M	M	High	M	M	M	Medium	-	-	-	-	M	M	M	Low	High
Invasive exotic plant species	-	-	-	-	L	H	M	High	L	H	M	Medium	-	-	-	-	-	-	-	-	High
Large public works projects (e.g, dams)	-	-	-	-	L	V	M	High	L	V	M	Medium	-	-	-	-	-	-	-	-	High

EXHIBIT 22

Factor A continued

	Stress																				
	Unidentified potential habitat				Habitat fragmentation				Habitat destruction				Incompatible management of private lands				Incompatible management of public lands				
	Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		
	V	V	Very high		V	V	Very high		H	H	High		M	M	Medium		L	M	Low		
Source of stress	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	**Factor A overall threat rank**
Lack of incentives to maintain / restore panther habitat	-	-	-	-	H	M	M	High	H	M	M	Medium	H	M	M	Low	-	-	-	-	High
Lack of complete data in historical range	M	M	M	High	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	High
Right of ways	-	-	-	-	L	V	M	High	-	-	-	-	-	-	-	-	-	-	-	-	High
Conversion of habitat to silviculture	-	-	-	-	L	L	L	Medium	L	L	L	Low	-	-	-	-	-	-	-	-	Medium
Mining and mineral exploration	-	-	-	-	L	M	L	Medium	L	M	L	Low	-	-	-	-	-	-	-	-	Medium
Conflicting mandates	-	-	-	-	-	-	-	-	-	-	-	-	H	H	H	Medium	L	H	M	Low	Medium
Conflicting management of other species	-	-	-	-	-	-	-	-	-	-	-	-	L	L	L	Low	L	L	L	Low	Low
Lack of implementation of management plans	-	-	-	-	-	-	-	-	-	-	-	-	H	M	M	Low	L	M	L	Low	Low

EXHIBIT 22

REINTRODUCTION

Factor B: Overutilization for commercial, recreational, scientific, or education purposes.

	Stress				
	Overutilization for scientific purposes				
	Severity	Scope	**Stress rank**		
	L	H	Low		
Source of stress	Contribution	Irreversibility	Rank	**Threat rank**	**Factor B overall threat rank**
Impacts of capture and monitoring	L	L	L	Low	Low
Impacts of removals for reintroductions to donor populations	L	L	L	Low	Low

EXHIBIT 22

REINTRODUCTION

Factor C: Disease and predation.

	Stress												
	Disease				Parasites				Predation				
	Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		
	L	H	Low		L	H	Low		L	L	Low		
Source of stress	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	**Factor C overall threat rank**
Feline leukemia	M	L	M	Medium	-	-	-	-	-	-	-	-	Medium
Rabies	M	M	M	Low	-	-	-	-	-	-	-	-	Low
Pseudorabies	H	M	M	Low	-	-	-	-	-	-	-	-	Low
Hookworm	-	-	-	-	H	M	M	Low	-	-	-	-	Low
Manges	-	-	-	-	H	M	M	Low	-	-	-	-	Low
Unknown / other	L	L	L	Low	L	L	L	Low	-	-	-	-	Low
All sources of predation	-	-	-	-	-	-	-	-	V	M	H	Low	Low

EXHIBIT 22

REINTRODUCTION

Factor D: The inadequacy of existing regulatory mechanisms.

	Stress												
	Inadequate land use planning or regulation				Lack of agency coordination				Inconsistent state regulation or protection				
	Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		
	V	V	Very high		H	V	High		H	L	Low		
Source of stress	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	**Factor D overall threat rank**
Inadequate development, implementation, and enforcement of comprehensive plans and zoning	V	H	V	Very high	-	-	-	-	-	-	-	-	Very high
Inadequate growth management planning and implementation	V	H	V	Very high	-	-	-	-	-	-	-	-	Very high
Little or no protection of upland habitats	H	H	H	Very high	-	-	-	-	-	-	-	-	Very high
Inadequate development, and implementation of corridor / greenway planning	V	H	V	Very high	-	-	-	-	-	-	-	-	Very high
Lack of cumulative impacts evaluation	H	H	H	Very high	-	-	-	-	-	-	-	-	Very high
Inadequate land conservation of acquisition programs	H	H	H	Very high	-	-	-	-	-	-	-	-	Very high

EXHIBIT 22

Factor D continued

	Stress												
	Inadequate land use planning or regulation				Lack of agency coordination				Inconsistent state regulation or protection				
	Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		
	V	V	Very high		H	V	High		H	L	Low		
Source of stress	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	**Factor D overall threat rank**
Lack of public awareness of environmental issues and needs	H	H	H	Very high	-	-	-	-	-	-	-	-	Very high
Conflicting laws, regulations, mandates, or policies	M	M	M	High	-	-	-	-	H	M	M	Low	High
No mechanism for agency communication or coordination	-	-	-	-	H	L	M	Medium	H	L	M	Low	Medium
Lack of a mutually defined common goal	-	-	-	-	H	L	M	Medium	H	L	M	Low	Medium
Interagency distrust and lack of relationships and partnerships	-	-	-	-	M	M	M	Medium	-	-	-	-	Medium

EXHIBIT 22

REINTRODUCTION

Factor E: Other natural or manmade factors affecting the Florida panther's continued existence.

	Stress															
	Public / landowner resistance to reintroduction				Political and agency resistance to reintroduction				Human / panther interactions				Panther mortality			
	Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**	
	V	V	Very high		V	V	Very high		H	V	High		H	V	High	
Source of stress	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**
Public perception, misconception, and lack of knowledge	V	M	H	Very high	-	-	-	-	V	M	H	High	-	-	-	-
Conflicts with livestock (attacks on)	V	M	H	Very high	V	M	H	Very high	M	M	M	Medium	-	-	-	-
Public fear of panthers (including fear of attacks / mortality)	V	H	V	Very high	V	H	V	Very high	-	-	-	-	-	-	-	-
Distrust of government agencies	H	H	H	Very high	H	H	H	Very high	-	-	-	-	-	-	-	-
Agency funding and resource constraints	-	-	-	-	V	M	H	Very high	-	-	-	-	-	-	-	-
Lack of incentives for states	-	-	-	-	H	H	H	Very high	-	-	-	-	-	-	-	-

	Stress																
	Genetic viability and population connectivity				Conflicting prey management				Conflicts with escaped pumas				Competition with other species				
	Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		
	M	H	Medium		M	H	Medium		L	M	Low		L	H	Low		
Source of stress	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	**Factor E overall threat rank**
Public perception, misconception, and lack of knowledge	-	-	-	-	H	M	M	Low	-	-	-	-	-	-	-	-	Very high
Conflicts with livestock (attacks on)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Very high
Public fear of panthers (including fear of attacks / mortality)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Very high
Distrust of government agencies	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Very high
Agency funding and resource constraints	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Very high
Lack of incentives for states	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Very high

EXHIBIT 22

Factor E continued

Source of stress	Public / landowner resistance to reintroduction				Political and agency resistance to reintroduction				Human / panther interactions				Panther mortality				Genetic viability and population connectivity				Conflicting prey management				Conflicts with escaped pumas				Competition with other species				Factor E overall threat rank
Stress	Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		
	V	V	Very high		V	V	Very high		H	V	High		H	V	High		M	H	Medium		M	H	Medium		L	M	Low		L	H	Low		
Source of stress	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	**Factor E overall threat rank**
Agency's fear of liability (political, financial, and professional)	-	-	-	-	V	M	H	Very high	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Very high
Public official's fear of losing constituent's support	-	-	-	-	H	H	H	Very high	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Very high
Influence of opposing special interest groups on public officials	-	-	-	-	V	V	V	Very high	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Very high
Conflicts with hunters and hunting	H	M	M	High	H	M	M	High	H	M	M	Medium	-	-	-	-	-	-	-	-	H	M	M	Low	-	-	-	-	-	-	-	-	High
Landowner fear of regulation, lost property rights, and negative economic consequences	H	M	M	High	H	M	M	High	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	High

EXHIBIT 22

Factor E continued

	Stress															
	Public / landowner resistance to reintroduction				Political and agency resistance to reintroduction				Human / panther interactions				Panther mortality			
	Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**	
	V	V	Very high		V	V	Very high		H	V	High		H	V	High	
Source of stress	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**
Media sensationalism and panther myths	M	M	M	High	M	M	M	High	-	-	-	-	-	-	-	-
Relationships among potential supporting landowners and their neighbors	M	M	M	High	M	M	M	High	-	-	-	-	-	-	-	-
Lack of panther information dissemination to public officials and agencies	-	-	-	-	H	L	M	High	-	-	-	-	-	-	-	-
Road kills	-	-	-	-	-	-	-	-	-	-	-	-	H	H	H	High
Illegal kill	-	-	-	-	-	-	-	-	-	-	-	-	H	M	M	Medium
Accidental death (including contaminants)	-	-	-	-	-	-	-	-	-	-	-	-	L	H	M	Medium

	Stress																
	Genetic viability and population connectivity				Conflicting prey management				Conflicts with escaped pumas				Competition with other species				
	Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		
	M	H	Medium		M	H	Medium		L	M	Low		L	H	Low		
Source of stress	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	**Factor E overall threat rank**
Media sensationalism and panther myths	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	High
Relationships among potential supporting landowners and their neighbors	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	High
Lack of panther information dissemination to public officials and agencies	-	-	-	-	M	L	L	Low	-	-	-	-	-	-	-	-	High
Road kills	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	High
Illegal kill	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Medium
Accidental death (including contaminants)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Medium

EXHIBIT 22

Factor E continued

	Stress																																
	Public / landowner resistance to reintroduction				Political and agency resistance to reintroduction				Human / panther interactions				Panther mortality				Genetic viability and population connectivity				Conflicting prey management				Conflicts with escaped pumas				Competition with other species				
	Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		
	V	V	Very high		V	V	Very high		H	V	High		H	V	High		M	H	Medium		M	H	Medium		L	M	Low		L	H	Low		
Source of stress	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	**Factor E overall threat rank**
Natural catastrophes	-	-	-	-	-	-	-	-	-	-	-	-	L	V	M	Medium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Medium
Small number of founder panthers available	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	V	M	H	Medium	-	-	-	-	-	-	-	-	-	-	-	-	Medium
Unidentified or secured pathways for dispersal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	H	H	H	Medium	-	-	-	-	-	-	-	-	-	-	-	-	Medium
Deer management	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	V	M	H	Medium	-	-	-	-	-	-	-	-	Medium
Intraspecific aggression or predation	-	-	-	-	-	-	-	-	-	-	-	-	L	M	L	Low	-	-	-	-	-	-	-	-	-	-	-	-	L	M	L	Low	Low
Removal of panthers for management purposes	-	-	-	-	-	-	-	-	-	-	-	-	L	M	L	Low	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Low

EXHIBIT 22

Factor E continued

	Stress																																
	Public / landowner resistance to reintroduction				Political and agency resistance to reintroduction				Human / panther interactions				Panther mortality				Genetic viability and population connectivity				Conflicting prey management				Conflicts with escaped pumas				Competition with other species				
	Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		Severity	Scope	**Stress rank**		
	V	V	Very high		V	V	Very high		H	V	High		H	V	High		M	H	Medium		M	H	Medium		L	M	Low		L	H	Low		
Source of stress	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	Contribution	Irreversibility	Rank	**Threat rank**	**Factor E overall threat rank**
Panther visibility to local public	-	-	-	-	-	-	-	-	M	L	L	Low	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Low
Inadequate regulation or understanding of distribution and occurrence of pet puma	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	H	M	M	Low	-	-	-	-	Low
Competition with other large predators	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	L	L	L	Low	Low
Feral hog management	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	H	M	M	Low	-	-	-	-	-	-	-	-	Low

APPENDIX C. Summary of Comments Received

The FWS received comments on the Technical / Agency Draft from 33,739 individuals / organizations. Of these, 33,676 individuals commented through the Defenders of Wildlife website. These comments were faxed to the FWS South Florida Field Office in Vero Beach, Florida. With few exceptions, these comments were identical and followed the suggested wording on the website. The remaining 63 individuals / organizations offered 299 comments.

Support for the Recovery Plan and suggested edits to text

Ten commenters stated that they were supportive of the Recovery Plan and offered no changes. One-hundred twenty-two comments regarded suggested edits to the text.

FWS Response

The FWS considered all suggested edits and incorporated those that were appropriate.

Criteria and need for interim goals and supporting actions

Seven commenters offered 11 comments concerning the recovery criteria and the need of interim goals. These commenters believed that the recovery criteria have little or no chance of being realized. It was suggested that achievable goals or benchmarks be set that would reduce the risk of extinction to acceptable levels and suggested a target of establishing 3 separate populations of approximately 80 animals (a total of 240).

FWS Response

The population size of 240 for a viable Florida panther population was derived from the most recent PVA. The Recovery Team believes that 3 populations are needed for redundancy and resiliency. FWS agreed that an interim goal of 3 subpopulations of 80 animals each was needed to show that progress towards the recovery criteria is being achieved. This interim goal and associated criteria were added.

Panther Range and Taxonomy

Five commenters offered 10 comments questioning the accuracy of Young and Goldman's 1946 range map for the Florida panther in regards to taxonomic status. Commenters further stated that given the arbitrary nature of the estimated historic range and new information regarding genetic ancestry and the current state of the science, the plan appears to rest on a rather weak foundation.

FWS Response

The map in Young and Goldman (1946) is the most current and best available historic range map for the Florida panther. The degree to which the scientific community has accepted the use of genetics in puma taxonomy is not resolved at this time. Additional research is needed to understand genetic and morphological similarities and differences of puma across North America.

Panther Habitat

Development / Habitat Protection--The majority of the 36 comments received from 24 commenters concerning panther habitat had little to do with the Recovery Plan and were directed at the FWS's regulatory process. It was suggested that FWS place primary emphasis on protecting and restoring panther habitat in Florida by not permitting development in panther habitat. They felt that too often developers have been permitted to build developments that directly impact the survival of the panther.

FWS Response

Through section 7 of the ESA, as amended, the FWS works with Federal agencies to ensure that any action that is federally funded, authorized, or carried out that may affect the Florida panther does not jeopardize the continued existence of the panther. The FWS works with Federal agencies to emphasize the identification of potential conflicts in the early stages of project planning and advises the agencies and applicants on means to avoid adverse impacts. In addition to habitat conservation, important compensation strategies include the configuration of new roads to direct traffic away from panther habitat and the construction of wildlife crossings aimed primarily at allowing panthers to pass safely from one side of a road to another. The section 7 process can be complemented by activities such as fee-title acquisition, easements, and other local, State, and Federal conservation tools to achieve maximum benefits.

Critical Habitat--Four commenters suggested the need to designate critical habitat for the Florida panther.

FWS Response

When the panther became a listed species pursuant to the ESA in 1973, critical habitat was not designated. Designation of critical habitat for a species could occur only through a rulemaking process that would include opportunity for public comment. Because it is listed as endangered pursuant to the ESA, the panther and its habitat receive protection whether or not they are in an area designated as critical habitat.

Panther Management and Research

Annual counts or other census techniques--One commenter stated that the Recovery Plan should explicitly commit the three agencies to coordinate efforts to conduct annual verified counts or other appropriate census techniques to track progress made towards achieving a self-sustaining, viable population. A second commenter stated that the Population Trends and Distribution section would benefit from a description of the extensive annual field surveys conducted since 1981 by McBride for the FWC.

FWS Response

An FWS recovery plan does not commit other agencies to conduct specific tasks; it does however recommend which agencies / organizations would be best suited to accomplish certain tasks. Since 1981, an annual count of documented panthers has been conducted. Roy McBride drafted the Population Trends and Distribution section for the Recovery Plan and more details about annual field surveys discussed therein can be found in the literature.

Provide crossing points on the Caloosahatchee River and create a panther corridor to North Florida and South Georgia--28 comments were received from 17 commenters suggesting that the Recovery Plan address providing panther crossing points along the Caloosahatchee River to facilitate movement to the north and create a panther corridor that would connect habitat in south Florida with habitat in north Florida and Georgia by linking the Ocala National Forest and Okeefenokee National Wildlife Refuge.

FWS Response

As described in the Recovery Plan, the Dispersal Zone encompasses 44 mi^2 (113 km^2) with a mean width of 3.4 mi (5.4 km). 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. Within south-central Florida, corridors have been identified to connect potential panther habitat patches (Thatcher et al. 2006a). The Florida Ecological Greenways Network (Hoctor 2004) identifies and prioritizes landscape corridors that would also serve as panther travelways.

Growing transportation threats--Sixteen commenters offered 19 comments concerning panthers and highways. Some felt that the Recovery Plan trivializes the impact that transportation has had and continues to have on the current population. Suggestions were made to "Prohibit road development in panther habitat and retrofit existing highways that experience panther mortality with crossing underpasses similar to I-75." Others, however, felt that too much emphasis was placed on highway underpasses and that "…it would be misleading to infer that crossings can adequately substitute for sound transportation and land use planning that realistically assess the harm suffered by wildlife and for landscape level habitat protection."

FWS Response

FWS agrees that roads are one of the major sources of mortality for the panther population as well as limiting their ability to disperse and travel across the landscape. We believe that the potential impact of roads to the conservation and recovery of the panther is adequately addressed in the Recovery Plan and we are working closely with public and private entities to help minimize these impacts.

Genetics management plan--One comment was received encouraging the continued monitoring of physical and physiological characteristics correlated with inbreeding and depletion of genetic variability along with the development and implementation of a genetics management plan that would detect levels of heterozygosity that may trigger future introgressions of genetic material into the southern Florida population.

FWS Response

FWC continues to monitor panther physical and physiological characteristics correlated with inbreeding and depletion of genetic variability. The genetics data collected over the past two decades is being analyzed and published and will be used to help map future panther management actions.

Captive breeding program--One commenter suggested that a limited captive breeding program be considered as a hedge against sudden extinction.

FWS Response

The history of Florida panther captive breeding is presented in the Recovery Plan. The captive breeding program for panthers was discontinued in the early 1990s due to the fact that the genetic health of the Florida panther population had deteriorated to a point where continued survival was questionable, even with selective breeding within a captive population. Genetic restoration by simulating natural gene flow through introducing animals from western puma populations has proven to be more successful. This plan does consider the establishment of a captive breeding program to address other issues, however.

Monitor prey densities--Two commenters made 2 comments to the effect that prey animals should be monitored along with panthers as part of the recovery program.

FWS Response

FWS agrees that prey animals should be monitored along with panthers, and one of the actions in the Recovery Plan is to assess and monitor the status of deer populations in panther habitat.

PVA--One individual commented that the continued focus on panther demographics is strongly warranted and that the key vital rates for data collection should be kitten survival and adult female survival. However, they were not sure that convening another group of experts to conduct a PVA with existing data would be worthwhile unless solid new data are obtained on vital rates and variation in those rates. Also, they were uncertain whether Root's PVA was based on the Florida panther population only or on a hypothetical metapopulation of *Puma* as would be meaningful for the entire southeast region.

FWS Response

FWS and FWC are cooperatively funding a new PVA project that is analyzing new as well as reanalyzing old data. This PVA project should be completed by the end of 2008. The Root model was based on the Florida panther population as well as a hypothetical metapopulation and would be meaningful for the entire southeast region.

Independent scientific review of recovery program--One individual recommended that the Recovery Plan "provide for an independent scientific review panel of the recovery program that would issue annual reports on panther recovery."

FWS Response

There is no requirement for FWS to provide for an independent scientific review panel. FWC, NPS, and FWS prepare scientifically based annual updates on the status of panther recovery; however, these updates are not reviewed by an independent scientific panel.

Add research questions that need to be addressed--One individual commented that "the paper by Janis and Clark (2002) on the effects of ORV use and hunting on panthers is exemplary for its experimental design. This Plan should recommend more such studies about other subjects. The plan is particularly weak in its lack of attention to the identification of important questions that could be addressed with experimental management approaches."

FWS Response

Almost any recovery action mentioned in this plan could be addressed with experimental management approaches. The purpose of this plan is to outline the actions necessary to recover the panther to the extent that it can be reclassified and eventually delisted.

Panther Translocation / Reintroduction

Opposed / supports translocation / reintroduction--Ten comments were received from 8 commenters that were opposed to reintroduction into Arkansas (3), into Arkansas as it affects Missouri (2), Okefenokee National Wildlife Refuge (1), and Georgia (1). Seven comments by 4 commenters were supportive of the need to expand the breeding portion of the Florida panther population into south-central Florida and to establish viable populations in two areas in the southeastern U.S. outside of Florida.

FWS Response

The numbers of panthers required to obtain reclassification and delisting thresholds will require expansion of the existing population as well as the reintroduction of additional populations. Prior to any translocation / reintroduction efforts extensive cooperation / coordination will occur.

<u>Clarify the relative priorities and the process for translocation of panthers into central Florida versus other portions of the historic range</u>--Because the pool of individuals available for translocation into central Florida and other portions of the panther's historic range is limited, one individual felt that any decision to physically move cats out of the currently occupied range must be made in light of the competing goals involving range expansion and establishment of additional populations. They felt that the best available science indicates that translocation of panthers into central Florida would not only impede recovery but also would jeopardize panther survival. Two other commenters made 3 comments suggesting that any translocation of panthers would be considered a population "augmentation" versus a "reintroduction."

FWS Response

FWS will proceed cautiously by preparing an EIS that explores a reasonable range of translocation scenarios into central Florida and other portions of the historic range, and adequately presents the scientific information concerning habitat suitability for these areas and the biological limitations of the south Florida source population.

Panthers and habitat suitability north of the Caloosahatchee River-- Two commenters were concerned about a lack of activity by FWS in exploring the possible existence of a small but viable population of panthers in south-central Florida, especially in the western portion of this region. They suggested that an immediate systematic survey be conducted. Another commenter requested that additional information be provided about the land uses, potential conflicts, and size and connectivity of blocks of potential panther habitat in south-central Florida.

FWS Response

FWC conducted a systematic survey from July 1998 to June 2004 to determine the occurrence and status of panthers in south-central Florida and to evaluate the area's potential for expansion of the breeding population from south Florida (Belden and McBride 2006). No evidence of a breeding population of panthers was found. Dispersing males from the southern Florida population have immigrated into south-central Florida, but an absence of females has inhibited expansion of a breeding population into this area. This study suggested that three segments of remaining habitat possibly could support small numbers of panthers. A model to identify potential panther habitat in south-central Florida was also developed by Thatcher et al. (2006b).

Panther Effects on Humans

Increased potential for adverse human-panther encounters--One individual commented that they were uncertain about the socio-political feasibility of the Recovery Plan. Two other commenters recommended that due to the rapidly escalating significance of people-panther interactions, that the Human Dimensions discussion be expanded beyond the north Florida reintroduction research to include a brief synopsis of south Florida issues and the extant population. Another individual commented that FWS needs to clarify what is meant both by 'extreme' and 'permanent.'

FWS Response

FWS agreed and this section of the Recovery Plan was updated.

Recovery Plan threatens hunting / public access--Thirty-two comments were received from four commenters suggesting that more panthers would result in a loss in outdoor recreation to near zero, particularly hunting and use of ORVs. They believed that the Recovery Plan was intentionally focused upon doing away with the traditional cultural community associated with the Gladesman folk culture of southern Florida.

FWS Response

The majority of outdoor recreational activities are compatible with panther recovery if they are conducted in a manner consistent with existing local, state, and Federal laws and regulations. The Recovery Plan is not aimed at any culture or traditional cultural practices. Our mandate was to write a plan that outlined actions necessary to recover the panther to the extent that it can be reclassified and eventually delisted.

APPENDIX D. List of Peer Reviewers

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