United States Department of the Interior

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

January 30, 2002

Colonel James G. May
District Engineer
U.S. Army Corps of Engineers
Post Office Box 4970
Jacksonville, FL 32232-0019

Log No.: 4-1-98-F-372
Application No.: 199402492 (IP-JB)
Dated: March 9, 1998
Applicant: Florida Rock Industries, Inc.
County: Lee

Dear Colonel May:

This document is the Fish and Wildlife Service's (Service) Biological Opinion for the proposed Fort Myers Mine #2 in Lee County, Florida, and its effects on endangered Florida panthers (*Puma concolor coryi*) in accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (ESA).

This Biological Opinion is based on information provided in the Public Notice for the proposed action, field investigations, meetings, letter correspondence, email correspondence, and phone conversations with the U.S. Army Corps of Engineers (Corps); the applicant - Florida Rock Industries, Incorporated; the applicant's consultants - Kevin L. Erwin Consulting Ecologist, Incorporated, Passarella and Associates, Incorporated; the applicant's attorneys - Humphrey and Knott, P.A., Hopping Green Sams & Smith; the Environmental Protection Agency (EPA); the Florida Department of Environmental Protection, Bureau of Mine Reclamation (DEP); the Florida Fish and Wildlife Conservation Commission (FWC); the South Florida Water Management District (SFWMD); the Southwest Florida Regional Planning Council (SWFRPC); the Corkscrew Regional Ecosystem Watershed (CREW) Land and Water Trust; Service staff, and other sources of information. A complete administrative record of this consultation is on file at the Service's Southwest Florida Suboffice in Naples, Florida.

Consultation History

The consultation history for Florida Rock Industries, Incorporated, Fort Myers Mine #2 involves four overlapping permit applications submitted during the past decade. Each permit application is discussed separately below. The primary emphasis of this biological opinion is on permit application **199402492 (IP-JB)**, formerly permit application 199402492 (IP-ML).

199605549 (IP-ML)

On October 28, 1996, the Corps issued a Public Notice for permit application 199605549 (IP-ML), expansion of an existing sand mine and part of Fort Myers Mine #2, for disturbance to 0.68 acre of jurisdictional wetlands. On December 6, 1996, the FWC transmitted comments on permit application 199605549 (IP-ML) to the Corps and the Service.

199706577 (IP-ML)

On December 10, 1997, the Corps issued a Public Notice for permit application 199706577 (IP-ML). The applicant proposed to construct a State of Florida, Department of Juvenile Justice halfway house and wilderness camp for juvenile delinquents and lease the property to Lee County. The Public Notice stated that the access road may be used for future mining activities.

On January 12, 1998, the Service transmitted a letter to the Corps concurring with a determination of "may affect, not likely to adversely affect" for endangered Florida panthers. The Service stressed additional avoidance and minimization and the need for a mitigation plan. In accordance with the procedural requirements of the 1992 404 (q) Memorandum of Agreement, Part IV, 3(a) the Service advised the Corps that the proposed work may affect aquatic resources of national importance and recommended denial.

On April, 1, 1998, the Corps transmitted a letter to the applicant's consultant stating that due to a lack of information needed to complete public review of permit application 199706577 (IP-ML), it would be withdrawn without prejudice and retained in the files for one year pending receipt of the requested information.

On October 28, 1998, the applicant's consultant hosted an interagency meeting in Fort Myers, Florida to discuss a modification to permit application 199706577 (IP-ML) and a proposed mitigation plan for associated wetland impacts.

On November 3, 1998, the Corps issued permit 199706577 (IP-ML) to the applicant for construction of the State of Florida, Department of Juvenile Justice halfway house and wilderness camp in Section 3, Township 46 South, Range 26 East, of Fort Myers Mine #2.

199904830 (NW-PW)

On January 1, 2000, the Corps recommended, via email, that the applicant's consultant circulate revised drawings for agency comment that showed the addition of the Harper Brothers mine to Fort Myers Mine #2. As a result of the applicant's acquisition of the Harper Brothers mine a federal court required the applicant to sell Fort Myers Mine #1. The sale included Phases 1A and 1B of Fort Myers Mine #2. The Corps felt the changes were relevant to the alternatives analysis especially with regard to haul routes but could not determine if the revisions warranted issuance of another Public Notice.

On January 19, 2000, the Corps issued a Public Notice for permit application 199904830 (NW-PW) for the proposed fill of 1.2 acres of jurisdictional wetlands in Phases 3A and 3B of Fort Myers Mine #1, a 1,194-acre area formerly known as Phases 1A and 1B of Fort Myers Mine #2.

On January 24, 2000, the Service requested from the Corps, a 16-day extension to the Public Notice comment period for permit application 199904830 (NW-PW).

On February 7, 2000 the Service transmitted comments on permit application 199904830 (NW-PW) to the Corps. The Service incorporated previous comments by reference and stated that the 1,194-acre proposal would "...result in more than minimal individual or cumulative adverse environmental effects..." (33 CFR 330.13) and that the project should be reviewed as an individual permit. In accordance with the procedural requirements of the 1992 404 (q) Memorandum of Agreement, Part IV, 3(a) the Service advised the Corps that the proposed work may affect aquatic resources of national importance.

Furthermore, the Service concurred with the Corps determination of "may affect" for endangered Florida panthers and threatened eastern indigo snakes and "may affect, not likely to adversely affect" for threatened bald eagles. The Service also anticipated adverse effects to endangered Everglade snail kites and endangered wood storks. The Service requested a complete formal consultation initiation package for the proposed action, as required in the regulations governing interagency consultations (50 CFR § 402.14) and recommended that the project be held in abeyance until the consultation process was complete.

On February 29, 2000, the Service notified the Corps that the 1,194-acre proposed action would have substantial and unacceptable impacts on aquatic resources of national importance pursuant to Part IV, 3(b) of the 1992 404 (q) Memorandum of Agreement (MOA).

199402492 (IP-ML)

On April 19, 1994, the applicant's consultant sent a letter to the Service requesting information on critical habitat and listed species preparatory to a wildlife survey on Fort Myers Mine #2.

On July 12, 1995, the applicant, applicant's consultant, DEP, FWC, Corps, and the Service visited Fort Myers Mine #2 to review preliminary mine plans, review the proposed impact area and mitigation area, discuss wetland and wildlife issues, and to discuss mine reclamation. Agency staff determined the western slough was an inappropriate site for a mitigation bank.

On September 26, 1995, the applicant held a pre-application meeting with the applicant's consultant, DEP, and the Corps. The Service was invited but unable to attend.

On October 4, 1995, the Corps sent a letter to the Service requesting initiation of early consultation on the Florida panther and the threatened eastern indigo snake (*Drymarchon corais couperi*). This iteration of the Fort Myers Mine #2 proposal included a 2,000-acre impact area and a 2,000-acre mitigation area.

On December 5, 1995, the applicant's consultant transmitted the results of a listed species survey, a conceptual mitigation bank plan, and a series of maps depicting drainage, land cover, the impact site, and the mitigation site to the Corps, the EPA, and the Service.

On December 19, 1995, the applicant hosted an interagency site visit at Fort Myers Mine #2 to review the proposed impact area and mitigation area, discuss wetland and wildlife issues, and to discuss mine reclamation.

On February 21, 1996, the applicant hosted an interagency site visit at Fort Myers Mine #2 to review the proposed impact area and mitigation area, discuss wetland and wildlife issues, and to discuss mine reclamation.

On May 7, 1996, the FWC transmitted pre-application comments to the DEP and provided a copy of the comments to the Service. In addition to the Florida panther and eastern indigo snake the FWC indicated the proposed action had the potential to impact threatened Audubon's crested caracaras (*Polyborus plancus audubonii*), threatened bald eagles (*Haliaeetus leucocephalus*), endangered Everglade snail kites (*Rostrhamus sociabilis plumbeus*), endangered wood storks (*Mycteria americana*), endangered red-cockaded woodpeckers (*Picoides borealis*), threatened American alligators (*Alligator mississippiensis*), and eleven species listed by the State of Florida as threatened or species of special concern. The FWC advocated that the applicant maintain a wildlife corridor between "Site H" and "Imperial Marsh" across the eastern end of the mine, that the wildlife corridor be placed under a conservation easement, and that the applicant restore farm fields there to upland forested habitat for the Florida panther and upland wildlife species.

On November 3, 1997, the applicant's consultant, FWC and the Service made a site visit to the slough in the western portion of Fort Myers Mine #2 to review proposed wetland impacts.

On December 3, 1997, the applicant's consultant and the Service made a site visit to the eastern portion of Fort Myers Mine #2 to review the proposed wildlife corridor.

On March 4, 1998, the applicant's consultant hosted an interagency presentation and meeting at the Calusa Nature Center in Fort Myers, Florida for Fort Myers Mine #2. The meeting focused on existing site conditions, mine plan development, the "Arnold Committee," conservation lands, and the status of requested permits.

On March 5, 1998, the Corps transmitted a biological evaluation for endangered Florida panthers, threatened bald eagles, endangered red-cockaded woodpeckers, and threatened eastern indigo snakes. The Corps provided a determination of "may affect" for these species.

On March 9, 1998, the Corps issued a Public Notice for permit application 199402492 (IP-ML) for proposed impacts to 359.1 acres of jurisdictional wetlands at the 6,070.6-acre Fort Myers Mine #2. This Public Notice also included wetland impacts proposed in the Public Notice for permit application 199706577 (IP-ML), construction of the State of Florida, Department of Juvenile Justice halfway house and wilderness camp.

On March 19, 1998, the applicant, the applicant's attorney, the applicant's consultant, Lee County, DEP, FWC, Corps, EPA, and the Service met at the Calusa Nature Center in Fort Myers, Florida to discuss surface water management issues, wetland impacts, wetland mitigation, listed species, and the project's history. The group agreed that the Wetland Rapid Assessment Procedure (WRAP) should be used to assess wetland impacts and mitigation. The Corps determined that preservation of farm fields in the wildlife corridor would not generate credit to off-set wetland impacts. The applicant agreed to revise wetland mitigation plans to include wetland enhancement, wetland creation, and upland enhancement in the wildlife corridor. The applicant agreed to investigate potential hydrologic improvements to the western slough.

On April 7, 1998, the EPA requested a 30-day extension to the Public Notice comment period for permit application 199402492 (IP-ML).

On April 8, 1998, the Service transmitted comments to the Corps emphasizing the importance of the project site to endangered Florida panthers and recommending that the applicant follow the Standard Protection Measures for the Eastern Indigo Snake. The Service indicated that additional wetland avoidance and minimization was feasible and that the proposed mitigation was insufficient. In accordance with the procedural requirements of the 1992 404 (q) Memorandum of Agreement, Part IV, 3(a) the Service advised the Corps that the proposed work may affect aquatic resources of national importance and recommended denial.

On April 9, 1998, the FWC transmitted comments to the Corps and the Service reiterating their position and recommendations of December 9, 1996 and May 7, 1996.

On April 14, 1998, the Corps transmitted a letter to the applicant's consultant stating that the alternatives analysis, avoidance and minimization were insufficient and that the proposed project did not comply with Section 404 (b)(1) Guidelines. The Service's response was attached.

On April 29, 1998, the Service notified the Corps that the proposed action would have substantial and unacceptable impacts on aquatic resources of national importance pursuant to Part IV, 3(b) of the 1992 Memorandum of Agreement (MOA) between the Corps and the Service.

On May 6, 1998, the EPA notified the Corps in accordance with the procedural requirements of the 1992 404 (q) Memorandum of Agreement, Part IV, 3(a) that the proposed work may affect aquatic resources of national importance and recommended denial.

On June 3, 1998, the EPA notified the Corps in accordance with the procedural requirements of the 1992 404 (q) Memorandum of Agreement, Part IV, 3(b) that the proposed work may affect aquatic resources of national importance and continued to recommended denial.

On July 4, 1998, the Corps transmitted the Service's April 29, 1998 and EPA's June 3, 1998 letters to the applicant and requested that the applicant provide a response to all comments received during the Public Notice review period.

On October 7, 1998, the applicant, applicant's attorney, applicant's consultant, Lee County, DEP, Corps, EPA, and the Service met at the Calusa Nature Center in Fort Myers, Florida. The applicant's consultant presented an updated vegetative cover map, preliminary WRAP results, a wildlife corridor mitigation plan, and a proposed hydrological restoration plan for the western slough. Agency staff requested revised project drawings and relevant narrative for review and proposed a site visit to review the WRAP scores.

On November 20 and 21, 1998, the applicant's consultant hosted an interagency site visit at Fort Myers Mine #2 to review the WRAP analysis for the impact site and the mitigation site.

On July 12, 1999, the applicant's consultant transmitted an updated set of project plans and a response to all concerns raised by the Service, the FWC, and EPA.

On August 22, 2000, the applicant's consultant met with the Corps in Tampa, Florida.

On September 8, 2000, the applicant's consultant transmitted a draft section 7 consultation initiation letter and project documentation to the Corps.

On September 11, 2000, the Corps transmitted an email requesting Service concurrence on a determination of "may affect" for endangered Florida panthers, endangered red-cockaded woodpeckers, threatened eastern indigo snakes and a determination of "may affect, not likely to adversely affect" for threatened Audubon's crested caracaras, threatened bald eagles, endangered Everglade snail kites, endangered wood storks, and endangered red-cockaded woodpeckers.

On September 21, 2000, the Corps transmitted a letter to the Service requesting concurrence on a determination of "no effect" for threatened bald eagles, "may affect" for endangered Florida panthers, threatened eastern indigo snakes, and "may affect, not likely to adversely affect" for

threatened Audubon's crested caracaras, endangered Everglade snail kites, endangered wood storks, and endangered red-cockaded woodpeckers.

On September 26, 2000, the applicant's consultant transmitted a biological evaluation to the Service containing a project description, project history, species biographies and a summary of impacts to, and conservation measures for, each of the listed species. The biological evaluation concluded that the Service should make a determination of "no effect" for threatened bald eagles, endangered red-cockaded woodpeckers, threatened Audubon's crested caracaras, endangered Everglade snail kites, endangered wood storks and "may affect, not likely to adversely affect" for endangered Florida panthers and threatened eastern indigo snakes.

On September 26, 2000, the applicant's attorney transmitted a packet of information and a letter to the Service stating that the Corps had requested initiation of consultation and that the applicant had recently retained the services of Dr. David Maehr, University of Kentucky.

On October 17, 2000, the applicant's attorney transmitted a letter to the Service stating that the Corps had requested initiation of consultation and requesting that the consultation commence as of September 26, 2000.

On December 7, 2000, the applicant's consultant hosted a meeting with the Corps and the Service in Fort Myers, Florida to discuss the issuance of the DEP permit, status of the Corps permit, status of a Service response to the applicant's July 12, 1999 letter, status of the section 7 consultation, and a proposed schedule for permit issuance.

On December 11, 2000, the Corps and the Service discussed via telephone Service concurrence on the Corps determination of effects to listed species, the extent of wetland losses, necessity of a pre- and post-development WRAP to support proposed mitigation, potential for future residential development around the mine pits, and greater emphasis to be placed on the value of agricultural lands to endangered Florida panthers.

On December 19, 2000, the applicant's attorney transmitted to the Service a copy of a letter addressed to the Corps lamenting the delay in the Service's review of the September 26, 2000 biological evaluation. The letter stated that the applicant disagreed with the Service's comment that residential development around the mine pits would not be subject to a future Corps permit and should therefore, be included as part of the "analysis of effects of the action."

On February 5, 2001, the applicant's attorney transmitted a letter to the Service reiterating concerns about delays during informal consultation and initiation of formal consultation.

On March 22, 2001, the applicant's consultant hosted an interagency site visit to Fort Myers Mine #2.

kittens were brought into the captive breeding program successfully reproduced an average of 10.4 months after the removal of the litter (Land 1994).

Early estimates of infant mortality varied and were in conflict. For example, Roelke *et al.* (1993) characterized infant mortality as relatively high with fewer than half of all births resulting in offspring that survive beyond six months of age (Roelke *et al.* 1993). Land (1994) estimated the kitten survival rate between age six months and one year at 0.895, based on a sample of 15 radio-instrumented kittens monitored from six months to one year of age.

Age at first reproduction has been documented at 18 months for females (Maehr *et al.* 1989b). The first sexual encounters for males has occurred at approximately three years of age (Maehr *et al.* 1991a). Dispersal of young typically occurs around 1.5 to two years of age, but may occur as early as one year of age (Maehr 1992a). Young panthers are considered recruited into the population when they have successfully reproduced (Dennis Jordan, Service, personal communication, 1997).

Females are readily recruited into the population as soon as they are capable of breeding (Maehr *et al.* 1991a). Males appear to have more difficulty being recruited. Sub-adult male recruitment is complicated by the lack of dispersal habitat and competition with adult male panthers for territories. Without large areas of suitable habitat to accommodate dispersal, young males have few opportunities for recruitment as residents. As a result, the panther's ability to increase and outbreed has been severely restricted. 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; documented mortality in radio-collared Florida panthers is greatest in sub-adult and non-resident males (Maehr *et al.* 1991b).

Foraging

Food habit studies of panthers in southwest Florida indicate that the feral hog is the most commonly taken prey followed by white-tailed deer, raccoon, and nine-banded armadillo (*Dasypus novemcinctus*). Deer and hogs accounted for 85.7 percent of consumed biomass north of Interstate 75 and 66.1 percent south of Interstate 75 (Maehr 1990a). No seasonal variation in diet was detected; however, panthers inhabiting an area of better soils consumed more large prey. Differences in prey abundance and availability were indicated by an eight-fold greater deer abundance north of Interstate 75 versus south of Interstate 75, although the estimated number of deer consumed did not differ between the north and south portions of the study area. Hog numbers were lower south of Interstate 75. Fewer large prey may, in part, explain the poorer physical condition, larger home ranges, and lower reproductive output of panthers south of Interstate 75. Hogs dominated the diet of panthers in the north in terms of both estimated biomass and numbers. In the south, deer accounted for the greatest estimated biomass consumed, whereas raccoons were the highest estimated number of prey items consumed. Domestic livestock were found infrequently in scats or kills, although cattle were readily available north of Interstate 75 (Maehr *et al.* 1990a).

Movements and Dispersal

Adult panthers occupy available habitat in southwest Florida in a pattern similar to that of western cougars (Land 1994). Over 7,000 telemetry locations on 26 radio-collared panthers between 1985 and 1990 indicated that home-range size varied from 21 to 461 square miles (53 to 1,183 square kilometers), averaging 200 square miles (519 square kilometers) for resident males and 75 square miles (193 square kilometers) for resident females. Home ranges of resident adults were stable unless influenced by the death of other residents. Home-range overlap was extensive among resident females and limited among resident males (Maehr *et al.* 1991a).

Dispersal distances average 36.4 miles (58.7 kilometers) for sub-adult males and 9.9 miles (16 kilometers) for an adult female. Mean dispersal age was 17.9 months. Dispersing males wander widely through unforested and disturbed areas (Maehr 1992a). The limited dispersal opportunities for sub-adult males may encourage fighting among males (Maehr *et al.* 1991a).

Activity levels for panthers peak around sunrise and sunset. The lowest activity levels occur during the middle of the day. Females at natal dens follow a similar pattern with less difference between high and low activity periods. Although some travel occurs during the day, panthers are mostly nocturnal (Maehr *et al.* 1990b).

There are no known differences in seasonal movements, wet and dry season habitat use, seasonal variation in diet, or effects of season on road crossings. There may be a response to fluctuations in water levels; however, the response is believed to be unmeasurable (Maehr 1989; Maehr *et al.* 1990b, 1991a).

Relationship to Other Species

The panther requires extensive, biotically-diverse landscapes to survive. Large carnivores are considered critical in maintaining ecological integrity in many large forested systems (Terborgh 1988). Landscapes through which the panther ranges support a vast array of south Florida's faunal and floral diversity. The panther's most important species association is with its prey species. Deer, hog, and raccoon are the most important prey species taken in term of biomass and numbers (Maehr *et al.* 1990a). Comparisons of food habits, habitat use, and movements revealed a low probability for competitive interactions among the panther, bobcat (*Lynx rufus*), and Florida black bear (*Ursus americanus floridanus*). All three species preferred upland forests but consumed different foods and utilized the landscape in ways that resulted in ecological separation (Maehr 1997).

Status and Distribution

The Florida panther was listed as endangered in 1967 (32 FR 4001); however, no critical habitat has been designated for the panther. The Florida population may have numbered as many as 500 at the turn of the century (Seal *et al.* 1989). Historically, the panther was distributed from eastern

Texas or western Louisiana and the lower Mississippi River valley east through the southeastern States in general, intergrading to the north with *P. c. cougar*, and to the west and northwest with *P. c. stanleyana* and *P. c. hippolestes* (Young and Goldman 1946) (Figure 3). The first bounty on Florida panthers was passed in 1832. Another Florida law passed in 1887 authorized a payment of $5.00 for panther scalps (Tinsley 1970). Hunting, habitat loss, and reduced prey availability have led to the decline of this species since that time (Belden *et al.* 1988, Maehr 1992a).

The State of Florida declared the panther a game species in 1950 and an endangered species in 1958. The population was estimated at 100 to 300 statewide in 1966 (Smith 1970, Schemnitz 1972). The Federal government listed panthers as endangered in 1967. The Service cited heavy hunting and trapping pressures, an inability to adapt to changes in the environment, and developmental pressures as the reasons for the decline of the panther (Service 1967). The Florida Panther Act, a State law enacted in 1978, made killing the panther a felony.

The Big Cypress population was estimated at 125 in 1969 (DOI 1969), and a south Florida population at 92 in 1972 (Schemnitz 1972). In the 1970s, the Florida Game and Fresh Water Fish Commission (the predecessor of the FWC) established a Florida Panther Record Clearinghouse to ascertain the status of the panther. The first field searches were made in 1972. Telemetry investigations began in 1981, primarily on public lands in southwest Florida. Maehr *et al.* (1991a) estimated the density of panthers in southwest Florida between February and July 1990 to be one panther per 42.9 square miles (110 square kilometers). When extrapolated over a 1,965.6 square-mile (5,040 square-kilometer) area thought to be occupied by radio-instrumented panthers in southwest Florida, the estimated population of the area was 46 adults (9 resident males, 28 resident females, and 9 transient males) between December 1985 and October 1990. This population estimate assumed homogeneous density and similar age and sex composition over time and space. The total population in south Florida was likely higher, because the estimation technique excluded panthers in ENP, eastern Big Cypress National Preserve, and areas north of the Caloosahatchee River (Maehr *et al.* 1991a). Logan *et al.* (1993) reports that based on road kills, tracks, scat, and a decade of radio telemetry data, the only reproducing panther population occurs in Collier, Miami-Dade, Hendry, and Lee counties in south Florida.

The Florida Panther Interagency Committee, based on data collected from 1981 through 1991 by the Florida Game and Fresh Water Fish Commission and NPS estimated the population at 30 to 50 adult panthers (Logan et al. 1993). Early population viability analyses projected extinction of the panther in 25 to 40 years under existing demographic and genetic conditions (Seal *et al.* 1989, 1992). The extant population is currently estimated at 78 (Roy T. McBride, personal communication, 2001). This number is 28 more than the 50 that the best currently available scientific information (Seal et al. 1989) indicates are needed to ensure demographic and genetic health in the extant population. For further information on trends in the number of collared panthers and panther habitat, see Figure 4.

Of the 27 recognized subspecies of *P. concolor* described by Hall (1981), the Florida panther is the sole remaining subspecies in the eastern United States. The panther presently occupies a contiguous system of native uplands and wetlands, agricultural lands including rangeland, and rural areas totaling about 2.2 million acres (890,000 hectares) on public and private lands in Charlotte, Glades, Lee, Hendry, Collier, Miami-Dade, Broward, Palm Beach, Monroe, and Highlands counties in south Florida (Maehr 1990a).

Geographic isolation, habitat loss, small population size, and associated inbreeding have resulted in the loss of approximately half of the panther's genetic diversity (Roelke 1990). Land *et al.* (2001) indicate that representation of Texas cougar genes in the southern Florida population is probably close to the goal of 20 percent, although two of the eight Texas females are over-represented. The occurrence of kinked tails and cowlicks has been reduced in intercross progeny. Information on other morphological traits associated with genetic isolation and inbreeding such as cryptorchidism, sperm deformities, atrial septal heart defects, and skull morphology cannot be collected until the intercross progeny mature or pass away. On the other hand, the fecundity of the intercross progeny would seem to indicate that sperm deformities have been reduced. For example, one first-generation male captured and examined in the field by Smithsonian theriogenologist Dr. Jo Gayle Howard had a sperm count three times that of a Florida panther, a sperm motility rate that was twice as high, a percentage of normal sperm that was four times greater, and a sperm concentration that was ten times higher (Roy T. McBride, personal communication, 2001). Since the genetic restoration program was initiated in 1995, the number of panthers censussed annually has increased, highway mortality has increased, and panthers have moved into formerly unoccupied niches on public land in south Florida. These are indications of a robust population that vary dramatically from population parameters prior to 1995. Florida panther and Texas cougar kitten survival to six months is currently estimated at 52 and 72 percent, respectively, and the average at 62 percent (Land *et al.* 2001).

Telemetry data represent the annual range and movements of radio-collared panthers and not that of uncollared panthers which may have been, or could be, present in the vicinity of the proposed action. The number of radio-collared panthers being monitored has increased from 8 in 1984 to 46 in 2001 (Land *et al.* 2001). The Geographic Information System database at the South Florida Field Office in Vero Beach indicates that one radio-collared panther (number 92) was recorded at the project site in Section 36, Township 45S, Range 26E on May 2, 2001. Four other radio-collared panthers (numbers 28, 64, 97, and 99) have been recorded within two miles, therefore it is reasonable to expect that they too would have used the project site at one time or another. These telemetry data indicate that this area is on the westernmost edge of occupied panther habitat. There is currently 1 radio-collared panther (number 99) (Darrell E. Land, personal communication, 2002) and 3 uncollared panthers, 1 female and 2 males, in the CREW population nearest the proposed project area (Roy T. McBride, personal communication, 2001). Throughout the occupied range of the panther, the CREW population represents at least five percent of the panther population known to the Service.

Recovery Plan Objective

Population viability analysis data indicate that a minimum of 50 adult panthers is needed to ensure demographic and/or genetic health (Seal *et al.* 1989). The present population is estimated at 78 panthers (Roy T. McBride, personal communication, 2001) following implementation of a genetic restoration program. Maehr (1990a) hypothesized that there was no unoccupied habitat suitable for dispersal by sub-adult panthers; however, with the recent population increase panthers are expanding into previously unoccupied or underutilized areas such as southern Big Cypress National Preserve.

A recent population viability analysis using a non-spatially explicit model known as VORTEX indicates a high probability of persistence for 100 years (Maehr *et al.* 1999), but concerns about model assumptions and data limitations make application of these results problematic. As a result, the Service has convened a panel of scientists tasked with completing a population viability analysis using a spatially explicit model known as RAMAS and updated demographic parameters. The results will then be used to better guide recovery and regulatory decisions.

Analysis for the species likely to be affected

On September 21, 2000, the Corps provided a determination of "no effect" for threatened bald eagles, "may affect" for endangered Florida panthers, threatened eastern indigo snakes, and "may affect, not likely to adversely affect" for threatened Audubon's crested caracaras, endangered Everglade snail kites, endangered wood storks, and endangered red-cockaded woodpeckers.

On September 19, 2001, the Service advised the Corps that formal consultation on endangered Florida panthers, threatened Audubon's crested caracaras, threatened bald eagles, endangered Everglade snail kites, endangered wood storks, endangered red-cockaded woodpeckers, and threatened eastern indigo snakes had been initiated.

Audubon's Crested Caracara

Sightings of caracara in Lee County are sporadic. Suitable habitat for threatened Audubon's crested caracara exists on the project site and a single caracara was observed in Section 31, Township 45S, Range 27E. Historic nesting records for the site do not exist and recent nesting surveys for caracara were negative. The applicant has agreed to conduct nesting season surveys for caracara prior to mining in each of the nine project phases. The Corps has provided a determination of "may affect, not likely to adversely affect" for threatened Audubon's crested caracaras. The Service concurs with the Corps' determination, therefore this species will not be further considered or discussed in this biological opinion.

Bald Eagle

An eagle nest, LE-49 was located 2.5 miles west of the project site in 1995. The nesting pair failed to raise any young in 1996 and the nest was documented down as of April 4, 1997. The nest was not rebuilt and is considered abandoned under the *Habitat Management Guidelines for the Bald Eagle in the Southeast Region* (Service 1987). No other nests have been observed on the project site. There are no known nests within 1,500 feet of the project site. It is possible that the 3,264.0 acres of open pit will attract bald eagles in the future. The Corps has provided a determination of "no effect" for threatened bald eagles. The Service concurs with the Corps' determination, therefore this species will not be further considered or discussed in this biological opinion.

Everglade Snail Kite

There are no Everglade snail kite nests onsite. Although snail kites are sometimes seen foraging in nearby borrow pits along Interstate 75 to the west, in Imperial Marsh to the south, and in Lehigh Acres to the north none were observed onsite during recent wildlife surveys.
The Corps has provided a determination of "may affect, not likely to adversely affect" for endangered Everglade snail kites. The Service concurs with the Corps' determination, therefore this species will not be further considered or discussed in this biological opinion.

Wood Stork

The proposed project is located eight to twelve miles north of the National Audubon Society's Corkscrew Swamp Sanctuary, home of the largest wood stork rookery in the United States. The number of nesting pairs at Corkscrew has declined from 6,000 in 1961 to 450 in 1998. The annual number of nesting pair between 1989 and 1998 ranged from a low of zero to a high of 1,200. The annual average during this ten year period is 500 pairs (National Audubon Society, unpublished data). There are no wood stork roosts or rookeries on-site. Survey results for foraging wood storks were positive.

The proposed action will impact 334.1 of 2,304.5 wetland acres (14 percent). The applicant proposes to preserve and enhance 429.7 acres of wetlands as part of an 802.0-acre wildlife corridor. The applicant also proposes to enhance 1,050.0 acres of wetlands known as the western slough. However, there is no commitment for the long-term maintenance and preservation of wetlands in the western slough. The long-term preservation and enhancement of 429.7 acres of wetland habitat and the short-term enhancement of 1,050.0 acres of wetlands will help stabilize foraging habitat and improve foraging conditions around the Corkscrew wood stork colony. The Corps has provided a determination of "may affect, not likely to adversely affect" for endangered wood storks. The Service concurs with the Corps' determination, therefore this species will not be further considered or discussed in this biological opinion.

Red-cockaded Woodpecker

Retaining mature pines, and young pines so that they become mature, as part of the project design is important to the recovery of red-cockaded woodpeckers in south Florida. The proposed action will impact 106.0 of 1,332.2 acres of pine habitats (8 percent). Melaleuca encroachment has reduced the foraging quality of about 660.6 acres or 50 percent of the pine habitats. There are two abandoned cavity trees located in Section 26, Township 45S, Range 26E. The applicant proposes to maintain a minimum 200 foot no-mining buffer around these trees. Morning and evening surveys beginning September 13, 2000 and ending September 20, 2000 were negative. The applicant proposes to preserve, enhance, and restore 291.0 acres of pine habitats in the 802.0 acre wildlife corridor. The long-term preservation and enhancement of 291.0 acres of pine habitats will help stabilize nesting habitat, foraging habitat, and improve foraging conditions for red-cockaded woodpeckers in and around the CREW.

The Corps has provided a determination of "may affect, not likely to adversely affect" for endangered red-cockaded woodpeckers. The Service concurs with the Corps' determination, therefore this species will not be further considered or discussed in this biological opinion.

Eastern Indigo Snake

An eastern indigo snake was observed during wildlife surveys. The applicant has agreed to use the Standard Protection Measures for the Eastern Indigo Snake. The Corps provided a determination of "may affect" for threatened eastern indigo snakes, however, after further analysis, the Service has concluded that the proposed action is not likely to adversely affect this species. The Service concurs with the Corps' determination, therefore these species will not be further considered or discussed in this biological opinion.

Florida Panther

A radio-collared panther has been documented on-site, four others have been documented within two miles of the project site, and three uncollared panthers have been documented in the CREW area near the project site. The proposed action will displace 3,677.0 acres of native wetlands, native uplands, and agricultural lands and isolate 1,592.0 acres of wetlands and upland buffers to the wetlands. The native habitats provide cover for panther prey and panthers. The agricultural lands provide food and cover for panther prey when fallow, provide a buffer to urban land uses, and until mined retain a potential for restoration to native cover types favored by panther prey and the panther. The proposed action will also enhance and preserve in perpetuity an 802.0-acre wildlife corridor. The Corps made a determination of "may affect" for the panther. The Service agrees that the proposed action "may affect" the panther and believes that the effects are likely to be adverse. These effects are discussed in detail in the section below titled *EFFECTS OF THE ACTION.*

ENVIRONMENTAL BASELINE

This section is an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species, its habitat (including designated critical habitat), and ecosystem, within the action area. The environmental baseline is a "snapshot" of a species' health at a specified point in time. It does not include the effects of the action under review in the consultation.

Status of the species within the action area

Since the action area includes the range of the Florida panther in south Florida, the information contained in the section titled *Status of the Species*, and the subsection titled *Status and Distribution*, establishes the Environmental Baseline for the Florida panther. The information from these sections are incorporated here by reference.

Factors affecting the species environment within the action area

Habitat trends

Habitat loss, habitat fragmentation, habitat degradation, and increased human disturbance resulting from agricultural and residential development are considered among the primary threats to long-term panther persistence. Statewide, between 1936 and 1987, cropland and rangeland increased 4.23 million acres (1.72 million hectares) or 30 percent, urban areas increased by 3.95 million acres (1.60 million hectares) or 538 percent, while herbaceous wetlands declined by 3.88 million acres (1.57 million hectares) or 56 percent and forests declined by 4.30 million acres (1.74 million hectares) or 21 percent (Kautz 1993, Kautz 1994). Kautz (1994) estimated that the 21 percent loss of forests was the equivalent of 35 to 70 male panther home ranges and 100 to 200 female panther home ranges. Continued development associated with the expansion of Florida's urbanized east coast, urban sprawl on the west coast, and the spread of agricultural development in the south Florida interior, have placed increasing pressure on panthers and panther habitat (Maehr 1990b, Maehr *et al.* 1991a, Maehr 1992b). Agricultural development continues to replace and fragment panther habitat. Over 83 percent of the 1.6 million acres (648,000 hectares) of agricultural land in southwest Florida is categorized as rangeland. Between 1986 and 1990, row crop acreage increased by 8,990 acres (3,640 hectares) or 21 percent; sugarcane increased by 16,000 acres (6,475 hectares) or 21 percent; citrus increased by 54,000 acres (21,850 hectares) or 75 percent; and rangeland, much of it suitable for panther occupation, decreased by 160,000 acres (64,750 hectares) or 10 percent. Rangeland losses were about evenly divided between agricultural and urban development (Townsend 1991). An update on agricultural land use allocation and trends will be available in early 2002 (Dallas Townsend, Hendry County, personal communication, 2001). The most recent information currently available from this area indicates that the amount of urban land and transitional land cleared and prepared for urban development between 1975 and 1993 increased from 641 square miles to

1,372 square miles; or 23 percent of Charlotte, Collier, Glades, Hendry, Lee, and Sarasota counties combined (Southwest Florida Regional Planning Council 1995).

Rapid development in southwest Florida has compromised the ability of landscapes to support a self-sustaining panther population (Maehr 1990b, 1992b). Maehr (1990a) reports that there are approximately 2.2 million acres (880,000 hectares) of occupied panther range in south Florida and that approximately 50 percent of the known breeding distribution is comprised of landscapes under private ownership. Maehr (1990a) indicated that development of private lands may limit panther habitat to landscapes under public stewardship.

Panthers consistently use large areas with few major highways (Maehr and Cox 1995). Belden and Hagedorn (1993) observed that Texas cougars used in a population reintroduction study established home ranges in an area with one-half the road density of the region in which the study was conducted. In particular, the study animals tended to avoid crossing more heavily traveled roads and favored crossing more lightly traveled roads. Female panthers rarely establish home ranges bisected by highways and maternal dens are located at distances of 0.62 mile (one kilometer) or more from highways (Maehr 1997).

Because of their wide-ranging movements and extensive spatial requirements, panthers are sensitive to habitat fragmentation (Harris 1985). Past land use activity, hydrologic alterations, road construction, and lack of fire management (Dees *et al.* 1999) have affected the quality and quantity of panther habitat. The effect of invasive plants on panther habitat utilization, particularly melaleuca, 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 to panthers, relative to habitat historically available to the species.

One indicator of trends in panther habitat is the number of times that the Service has provided technical assistance or consulted on projects that would affect panther habitat. Between June 3, 1980, and August 31, 2001, the Service provided technical assistance on 38 projects; concluded informal consultation on 33 projects totaling about 700 acres and concluded formal consultation on 42 projects totaling about 91,000 acres in the action area. Not all of these actions have resulted in loss of all of the panther habitat under consideration. Between March 29, 1984, and August 31, 2001, Corps permit applicants have preserved and enhanced 1,802.71 acres of panther habitat to off-set the direct and indirect effects of their projects. As of October 13, 2000, non-profit organizations, local governments, state and federal agencies have protected approximately 2.8 million acres of habitat. Each agency is managing their property for panthers and panther prey (Logan *et al.* 1993).

On the other hand, public lands available to the panther within the action area have increased from 2.3 million acres in 1984 to 2.8 million acres in 2001. The reader should note that, due to habitat quality, not all publicly owned land is suitable for panther occupation (*e.g.* mangrove islands and open water habitats); however, although Maehr (1990b) and others postulated that publicly owned lands could not support additional panthers, expansion of panthers into those

areas since 1995 has been dramatic. Of the 78 panthers currently known to the Service, 68 are found on these public lands (Roy T. McBride, personal communication, 2001).

Habitat management

Prescribed burning is probably the single most important habitat management tool available to public land stewards. Dees *et al.* (1999) examined panther use of habitat in response to prescribed burning at Florida Panther National Wildlife Refuge and Big Cypress National Preserve between 1989 and 1998. A positive temporal response to prescribed burns occurred in the year following the burn and is likely due to the rapid regrowth of vegetation, which in turn attracted white-tailed deer. Panther use of the burned area gradually declined after the first year and ended after four years. Prescribed burn rotations on both study sites is four years, but unfavorable weather conditions and logistics may sometimes extend the rotation.

Spatial responses to fire depended on scale. Panthers positioned their home ranges in areas more likely to be burned, whereas use of burned areas within the home range was less than non-burned areas. Although burnable habitats (pine) were not preferred within panther home ranges, they were used, with about 36 percent of the locations occurring in previously burned areas.

Dees *et al.* (1999) concluded that resource managers could improve panther habitat by reducing the proportion of area comprised of burns older than four years but cautioned that shorter burn rotations could alter vegetative patterns and have a negative impact at the landscape level.

Mortality, trauma, and disturbance

Records of mortality on documented uncollared panthers have been kept since February 13, 1972. Records of mortality on radio-collared panthers have been kept since February 10, 1981. Documented mortality ($n = 99$) of radio-collared and uncollared panthers averaged 3.4 per year through June 30, 2001. Male panthers accounted for 61 percent of mortality and females 38 percent. The sex of the remaining one percent could not be determined. Sub-adult panthers, up to three years of age, of both sexes accounted for 50 percent of mortality. Adult panthers of both sexes three years of age or older accounted for 50 percent of mortality. The causes of mortality were as follows: vehicular trauma - 44.4 percent; intraspecific aggression - 23.2 percent; unknown - 13.1 percent; old age, disease, etc. - 11.1 percent; shootings - 6.1 percent, and capture-related - 2.1 percent (Land *et al.* 2001). This summary includes only panthers endemic to south Florida for which sex and age was known and does not include introduced Texas cougars (*P. c. stanleyana*).

Florida panther vehicular trauma ($n = 45$) between February 13, 1972, and June 30, 2001, averaged 1.5 panthers per year. Males ($n = 25$) accounted for 56 percent of the vehicular trauma documented, and females ($n = 19$) for 42 percent. The gender of one panther (2 percent) could

not be determined (Land *et al.* 2001). Although the relative significance of vehicular trauma to other sources of mortality is not entirely known, it has been the most often documented source of mortality (Maehr 1989, Maehr *et al.* 1991b) because the death of uncollared panthers due to intraspecific aggression, old age, disease, etc. will often go undetected. Vehicular trauma in the panther population core has been eliminated on Interstate 75 and certain segments of Highway 29 through the use of wildlife underpasses and fencing (Lotz *et al.* 1996, Land *et al.* 2001). Vehicular trauma still occurs on outlying rural roads and efforts are underway to address the issue.

Florida panthers were hunted for bounty during the 1800s and for sport up until the 1950s. Seven panther shootings, six fatal and one non-fatal, occurred between 1978 and 1986. A female Texas puma introduced for genetic restoration was shot in 1998 (Land *et al.* 1999). Education, self-policing among hunters, and regulation are the tools by which shootings are minimized. All free-ranging puma in the southeastern U.S. are protected by a "similarity of appearance" provision in the Endangered Species Act.

Janis and Clark (1999) compared the behavior of panthers before, during, and after the recreational deer and hog hunting season (October through December) on areas open (Big Cypress National Preserve) and closed (Florida Panther National Wildlife Refuge, Fakahatchee Strand State Preserve) to hunting. The variables examined were: (1) morning activity rates, (2) movement rates, (3) predation success, (4) home range size, (5) home range shifts, (6) habitat selection, (7) distance from panther locations to trails, and (8) frequency of panther use in the Bear Island Unit of Big Cypress National Preserve. The authors failed to detect any relationship between hunting and the first six variables. Of the last two variables they determined that the distance of panther locations from trails increased an average of 0.31 mile (180 meters) and that the frequency of panther use in the Bear Island Unit decreased from 30 up to 40 percent during the hunting season. An analysis of movement rates, a measure of energy expenditure, and predation success, a measure of energy intake, do not indicate any direct, negative energetic responses to increased human activity during the hunting season. The other hand, the increase in average distance from trails and decrease in panther use of the Bear Island Unit are indicative of a behavioral change. Janis and Clark (1999) surmise that the increase in the distance of panther locations from trails is "biologically minor" and probably related to prey behavior (*i.e.* white-tailed deer moving deeper into the forest to avoid hunters). The decrease in panther use of the Bear Island Unit is balanced by an increase in use of private lands north of Big Cypress National Preserve as "refugia." The authors assert that this pattern would be of serious concern if panther habitat on these private lands were lost.

Recovery actions

To restore health and viability, a genetic management program was implemented with the release of eight female Texas cougars into south Florida in 1995. This program was designed to restore

the depressed panther genetic pool through the replacement of material from this formerly contiguous subspecies, without significant alteration in the basic genetic makeup of the panther or swamping the existing gene pool which may be adapted to local environmental conditions (Service 1994).

In addition, ten Florida panther kittens, five male and five female, were removed from the wild between February 1991 and August 1992 for captive breeding purposes. The kittens ranged in age from ten days to eight months and represented progeny of 11 different adult panthers. Two females died in captivity in 1992. One died after heart surgery in an attempt to correct an atrial septal heart defect and one died of unknown causes. Two captive males died of severe respiratory distress after being released to the wild in southern Big Cypress National Preserve in 1997. Six panthers remain in permanent captivity, one male and one female each, at White Oak Conservation Center in Yulee, Florida; Lowry Park Zoo in Tampa; and at the Jacksonville Zoo (Land and Taylor 1998).

The Service has attempted to establish two additional populations within the historic range of the panther (Service 1987, 1995). Between 1988 and 1995, 26 Texas cougars were released near Okeefenokee National Wildlife Refuge and Osceola National Forest. Studies have concluded that Florida panther reintroduction is biologically feasible (Belden and Hagedorn 1993, Belden and McCown 1996) based on available habitat in north Florida and south Georgia. On the other hand, complex social issues must be addressed prior to population reestablishment (Belden and McCown 1996).

EFFECTS OF THE ACTION

This section includes an analysis of the direct and indirect effects of the proposed action on the species and/or critical habitat and its interrelated and interdependent activities.

Factors to be considered

The 6,070.6-acre site of the proposed action is comprised of approximately 775.9 acres of forested uplands, 1,336.3 acres of forested wetlands, 156.0 acres of non-forested uplands, 709.4 acres of non-forested wetlands, 2,768.1 acres of agricultural land, and 324.9 acres of disturbed lands. The proposed action will result in 3,677.0 acres of direct effects, 1,592.0 acres of indirect effects, and 802.0 acres of beneficial effects to panther habitat.

The direct effects include displacement of 3,264.0 acres of native habitat and agricultural land by open mining pits. Another 413.0 acres of native upland habitat and agricultural lands will be disturbed during the mining process. The applicant will establish final contours on all unmined uplands outside of the wildlife corridor to stabilize slopes and reduce erosion. These reclaimed

areas will be planted with native species. A minimum of ten percent of the area will be planted to trees with the balance in shrubs and grasses. Reclamation will be performed consistent with Chapter 62C-36, F.A.C. and Condition 17 of DEP permit number 0134874-001.

The applicant is not compelled legally to protect unmined wetlands and upland buffers to the wetlands by fee-title or conservation easement. The cost of mitigating impacts to the wetlands is regarded by some as sufficient incentive to avoid and/or reduce wetland impacts. Upland buffers are provided to minimize the secondary or indirect effects to unmined wetlands. However, the long-term effects of mining on the hydrology of unmined wetlands are uncertain. It is possible that the hydrology to these wetlands, and therefore state or federal jurisdiction would be lost.

The proposed action was approved by Lee County through Zoning Resolutions ZAB-86-62 on May 13, 1986, Z-93-035 on August 2, 1993, and Z-97-022 on June 30, 1997. The proposed action is currently governed by the land use designation *Density Reduction -Groundwater Recharge*. Limestone mining is one of the permitted uses. Post-mining uses at Fort Myers Mine #2 are also currently governed by *Special Treatment Areas - Airport Noise Zones*. The western slough is subject to Airport Noise Zone 3 which prohibits only noise sensitive uses, *i.e.* residential uses and Airport Noise Zone 2 which excludes only mobile homes. The Service infers that uses not sensitive to airport noise are permissible but that such uses must first secure a zoning variance from the land use designation *Density Reduction - Groundwater Recharge*. The Service has reviewed projects, such as Florida Gulf Coast University, that received such a zoning variance and believes that future zoning variances are possible and even likely given development pressure in eastern Lee County. The eastern half of the project site, except for the wildlife corridor, is in Airport Noise Zone 1 and is not subject to any noise-related restrictions. For this reason the Service believes that all unmined wetlands and uplands are subject to reasonable and foreseeable future impacts.

The indirect effects include isolation of the 1,050.0-acre western slough and the isolation of 542.0 acres of wetlands on islands in the mining pits. The 1,050.0-acre western slough will be enhanced over a nine-year period but will not be preserved in perpetuity. The western slough connects undeveloped land associated with Florida Gulf Coast University on the southwest through Fort Myers Mine #2 to undeveloped land associated with Southwest Florida International Airport on the north. The western slough has the potential to provide habitat for panther prey and cover for dispersing sub-adult panthers but without a long-term plan for preservation and maintenance its value to the panther is tenuous. The 542.0 acres of wetlands will be isolated in borrow pits and of no value to panther prey or the panther.

The beneficial effects include the preservation and enhancement of an 802.0-acre wildlife corridor in the eastern portion of the property. The wildlife corridor is comprised of 147.0 acres of forested uplands, 93.0 acres of forested wetlands, 5.0 acres of non-forested uplands,

343.0 acres of non-forested wetlands, and 214.0 acres of agricultural land. Ownership to the land will be retained by Florida Rock Industries, Incorporated. A conservation easement was granted to the DEP November 7, 2000. The conservation easement is recorded in the Lee County courthouse at OR Book 3324, Page 2715. The terms of the easement and legal description are incorporated by reference. The 802.0-acre wildlife corridor connects two parcels known as "Site H" and "Imperial Marsh" recently protected by the Lee County Port Authority. Preserving and enhancing 802.0 acres of panther habitat in the CREW Ecological Unit (Logan *et al.* 1993) will minimize adverse effects to the panther by protecting that land from future development and improving conditions for feeding, breeding, and sheltering.

One measure of the effects of a proposed action is disturbance intensity or the effect the disturbance on a population or species as a function of the population or species' state after the disturbance (Service 1998). Disturbance intensity can be expressed as a unit or percentage of the population, designated critical habitat, occupied range, etc. The disturbance intensity, or amount of panther habitat affected by the proposed action, at the population level is 0.002 percent of an estimated 2.2 million acres occupied by the panther (Maehr 1990a). The disturbance intensity at the local level is 4.3 percent of the 121,800-acre CREW Ecological Unit. The disturbance intensity at the individual level is 4.1 percent and 11.0 percent of the average home range of a male and female panther respectively.

Another measure of the effects of the proposed action is disturbance severity or the effect of a disturbance as a function of the recovery rate (Service 1998). The recovery rate of the Florida panther is governed by genetic viability and habitat availability. The genetic restoration program appears to have improved the reproductive capability of the panther. Intercross progeny are rapidly multiplying, moving into formerly unoccupied habitats on public lands and to a lesser extent on private lands. Efforts are underway to protect and better manage those private lands essential to panther recovery. The genetic restoration program has reversed the genetic decline to extinction and provided an important temporal buffer in which resource agencies can devise and implement a means to protect sufficient lands to support a minimum viable population. The proposed action is a negligible fraction of the 99 percent range-wide reduction that resulted in listing of the panther as endangered.

Human activity at the site of the proposed action consists of that associated with ongoing mining activities, ongoing agricultural and cattle operations, powerline easement maintenance and permitting of the site for development. Trespass by humans is probably intermittent. Therefore, human activity is not likely limiting panther use at the site of the proposed action. As a result of the proposed action, activities associated with ongoing agricultural and cattle operations will be supplanted by activities associated with limestone mining operations.

The following is a summary of those factors or disturbances that affect the panthers environment in the action area. Occupied panther habitat in south Florida is about evenly divided between

public and private lands. The existing public lands currently support 68 panthers (R.T. McBride, 2001, personal communication) or 18 more than the minimum 50 adult panthers needed to support a genetically viable population (Seal *et al.* 1989). Soils on public lands are lower in quality than soils on private lands. Therefore, prey density and panther density, health, and reproduction tend to be lower in the southern portion of the breeding population than in the northern portion (Maehr 1992a). Current and historic rates of private land conversion to agricultural and urban development continue a trend of habitat loss, fragmentation, and degradation. The genetic restoration program appears to have improved the reproductive capability of the panther. Intercross progeny are rapidly multiplying, moving into formerly unoccupied habitats on public lands and to a lesser extent on private lands. Efforts are underway to protect and better manage those private lands essential to panther recovery. The genetic restoration program has reversed the genetic decline to extinction and provided an important temporal buffer in which resource agencies can devise and implement a means to protect sufficient lands to support a minimum viable population. As of October 13, 2000 non-profit organizations, local governments, state and federal agencies have protected approximately 2.8 million acres of habitat. The reader should note that due to habitat quality not all publicly owned land is suitable for panther occupation, *e.g.* mangrove islands and open water habitats. Studies have concluded that panther reintroduction in north Florida is biologically feasible but that complex social issues must first be addressed (Belden and Hagedorn 1993, Belden and McCown 1996).

Analyses for effects of the action

The proposed action will; (1) contribute to the permanent loss and fragmentation of panther habitat, (2) contribute to the permanent loss and fragmentation of habitat that supports panther prey, (3) limit the available habitat for dispersing sub-adult panthers, potentially contributing to an increase in intraspecific aggression between, and an increase in mortality of, sub-adult male panthers, (4) restrict the geographic distribution of the species, and (5) permanently protect and enhance panther habitat.

The proposed action will result in 3,677.0 acres of direct effects, 1,592.0 acres of indirect effects, and 802.0 acres of beneficial effects to panther habitat. The habitat losses anticipated are permanent but not immediate. Mining will occur in nine phases and is expected to be complete by 2040. Reclamation is expected to be complete by 2042. The direct affects to 3,677.0 acres and indirect affects to 1,592.0 acres of habitat are spread out over 40 years. The mining is projected to move generally from the west to the east.

The permanent loss of 3,677.0 acres of habitat and isolation of 1,592.0 acres of habitat will contribute to habitat fragmentation and eliminate dispersal opportunities for sub-adult males. Dispersing sub-adults may have to traverse occupied male panther territories, increasing the likelihood of intraspecific aggression. Intraspecific aggression and vehicular trauma are

important limiting factors in recruitment of sub-adult males into the breeding population. However, recent improvements in panther genetics has somewhat reduced the importance of recruitment of new sub-adult males. Some sub-adult males may be lost from the population without affecting overall reproductive success because established adult males are available to mate with all known females.

The permanent loss of 3,677.0 acres and isolation of 1,592.0 acres of habitat for panther prey will reduce foraging opportunities for dispersing sub-adults and adult panthers residing in the CREW area. Reduced foraging opportunities require a greater expenditure of energy to find sustenance and complete life cycle requirements. Over time, a reduction of prey habitat and available prey will result in increased competition among panthers for remaining prey, an increased risk of intraspecific aggression, and a reduction of the carrying capacity of occupied panther range.

Loss of suitable habitat for panther prey will further reduce the carrying capacity of occupied panther range. Loss of dispersal habitat for the panther will decrease the likelihood that a sub-adult male panther can survive long enough to be recruited into the breeding population. Seven sub-adult male panthers using the CREW Ecological Unit between 1988 and 2001 perished before they could be recruited into the breeding population. Human disturbances may deter use of adjacent habitat by panthers. Panther activity increases from the site of the proposed action southeast toward the geographic center of the population.

Preserving and enhancing an 802.0-acre wildlife corridor will protect that land from future development, provide habitat for dispersing sub-adult panthers, and habitat for panther prey. Adverse effects to the panther will be minimized by providing a contiguous landscape for the panther to feed, breed, and find shelter, and by providing opportunities for recovery-oriented research and management activities on publicly-owned lands.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this Biological Opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Anticipated future actions in the action area that will eliminate, fragment, or degrade panther habitat include the issuance of SFWMD permits. The SFWMD is responsible for permitting the construction, alteration, operation, maintenance, removal and abandonment of surface water management systems within its jurisdictional boundaries (SFWMD 1996). The SFWMD has issued 382 surface water management and ground water use permits for agricultural projects covering 948,480 acres (384,000 hectares) of the Immokalee Rise Physiographic Region

(Mazzotti *et al.* 1992). Many of the permits have not been executed and the Service is therefore unable to ascertain the extent and consequence of proposed agricultural developments. Under a worst case scenario this would equal a loss of 64 percent of the potential panther habitat in private ownership. The number of panthers affected cannot be determined since these lands have never been surveyed for panthers.

CONCLUSION

The disturbance intensity, or amount of panther habitat affected by the proposed action, at the population level is 5,269.0 acres, or 0.002 percent, of an estimated 2.2 million acres occupied by the panther (Maehr 1990a). The disturbance intensity at the local level is 4.3 percent of the 121,800-acre CREW Ecological Unit. The disturbance intensity at the individual level is 4.1 percent and 11.0 percent of the average home range of a male and female panther respectively.

After reviewing the current status of the panther, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is the Service's biological opinion that the development of Fort Myers Mine #2 by Florida Rock Industries, Inc., as proposed, is not likely to jeopardize the continued existence of the panther. No critical habitat has been designated for this species, therefore, none will be affected.

INCIDENTAL TAKE STATEMENT

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

The terms and conditions described below are non-discretionary, and must be undertaken by the Corps so that they become binding conditions of any grant or permit issued to Florida Rock Industries, Incorporated, as appropriate, for the exemption in section 7(o)(2) to apply. The Corps

has a continuing duty to regulate the activity covered by this incidental take statement. If the Corps (1) fails to assume and implement the terms and conditions or (2) fails to require Florida Rock Industries, Incorporated to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protection coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Corps or Florida Rock Industries, Incorporated must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR § 402.14(i)(3)].

Amount or extent of take anticipated

The Service has reviewed the Biological Opinion and all information relevant to the proposed action. Based on this review, the Service anticipates incidental take of panthers associated with the direct loss of 3,677.0 acres and the indirect loss or isolation of 1,592.0 acres of panther habitat. Incidental take should be minimized by implementation of the following reasonable and prudent measure. The incidental take is expected to be in the form of harm, injury or death due to habitat loss, and harassment, or disturbance.

The reasonable and prudent measure, with its implementing terms and conditions, is designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measure provided. The Federal agency must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measure.

Effect of the take

The proposed action will result in the preservation and enhancement of an additional 802.0 acres. The number of radio-collared panthers being monitored has increased from eight in 1984 to 46 in 2001 (Land *et al.* 2001). The cumulative incidental take of panthers expressed as acres of habitat lost increased from zero in 1984 to 16,195.15 acres in 2001. The proposed action will increase the cumulative incidental take of panthers expressed as acres of habitat lost from 16,195.15 acres to 21,463.75, an increase of 32 percent. Incidental take in the form of injury or mortality due to vehicular trauma has been anticipated for one panther since 1984. The cumulative loss of panther habitat to permitted Federal actions (direct effects only) increased from 530 acres in 1984 to 62,215.08 acres in 2001. The cumulative loss of panther habitat to permitted activities will increase about six percent from 62,215.08 acres to 65,892.08 acres. See Figure 4.

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the species when the reasonable and prudent alternatives are implemented.

Reasonable and prudent measures

The Service believes the following reasonable and prudent measure is necessary and appropriate to minimize the impacts of incidental take of panthers: Minimize the incidental take due to habitat loss, habitat fragmentation, and habitat degradation.

Terms and conditions

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

1. The Corps will include as special conditions to the permit, the conservation measures listed in the description of the proposed action (page 11).

2. The Corps will provide a copy of the final DA permit to the Service upon issuance. The Corps will monitor and ensure compliance with the DA permit conditions regarding conservation measures to minimize incidental take of panthers and provide the Service a report on implementation and compliance with the conservation measures within one year of the date of the DA permit.

3. Upon locating a dead, injured, or sick panther specimen, initial notification must be made to the nearest Service Law Enforcement Office (Mr. Vance M. Eaddy; Fish and Wildlife Service; 9549 Koger Blvd., Suite 111; St. Petersburg, Florida 33702; 727-570-5398). Secondary notification should be made to the Florida Fish and Wildlife Conservation Commission; South Region, 3900 Drane Field Road, Lakeland, Florida, 33811-1299; 1-800-282-8002. Care should be taken in handling sick or injured specimens to ensure effective treatment and care, or in the handling of dead specimens to preserve biological material in the best possible state for later analysis as to the cause of death. In conjunction with the care of sick or injured panthers or preservation of biological materials from a dead animal, the finder has the responsibility to carry out instructions provided by Law Enforcement to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed.

The reasonable and prudent measure, with its implementing terms and conditions, is designed to minimize the impact of incidental take that might otherwise result from the proposed action. The

Service believes that panthers associated with the direct loss of 3,677.0 acres and the indirect loss or isolation of 1,592.0 acres of habitat will be incidentally taken. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measure provided. The Federal agency must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measure.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1. Enhance all native habitat remaining in the western slough and place these lands under a conservation easement.

2. Institute an impact fee for each ton of minerals extracted from Fort Myers Mine #2 for protection of additional wetlands and wildlife habitat in eastern Lee County.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

REINITIATION NOTICE

This concludes formal consultation on the Florida Rock Industries, Incorporated, Fort Myers Mine #2. As provided in 50 CFR § 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

Examples of situations that may require reinitiation of formal consultation include: (1) a level of take that exceeds that which has been anticipated; (2) after peer review a new population viability analysis indicates the panther will require more land to sustain a minimum viable population; (3) significant project design modifications not previously considered; (4) substantial changes to the 802.0-acre wildlife corridor; and (5) publication of a final listing rule for the Big Cypress fox squirrel (*Sciurus niger avicennia*).

If you have questions regarding this Biological Opinion, please contact our office at (561) 562-3909, extension 234.

Sincerely yours,

for

James J. Slack
Field Supervisor
South Florida Ecological Services Office

cc:
Corps, Tampa, FL (Joe Bacheler)
Corps, Fort Myers, FL (Skip Bergman)
EPA, West Palm Beach, FL (Richard Harvey)
EPA, Ft. Myers, FL (Bruce Boler)
FWC, Tallahassee, FL (Brad Hartman)
FWC, Punta Gorda, FL (Jim Beever)
FWC, Naples, FL (Darrell Land)
Lee County Planning, Fort Myers, Florida (Rick Joyce)
SFWMD, Fort Myers, FL (Karen Johnson)
Service, FPNWR, Naples, FL (Jim Krakowski)
Service, Naples, FL (Andrew C. Eller, Jr.)
Florida Rock Industries, Incorporated

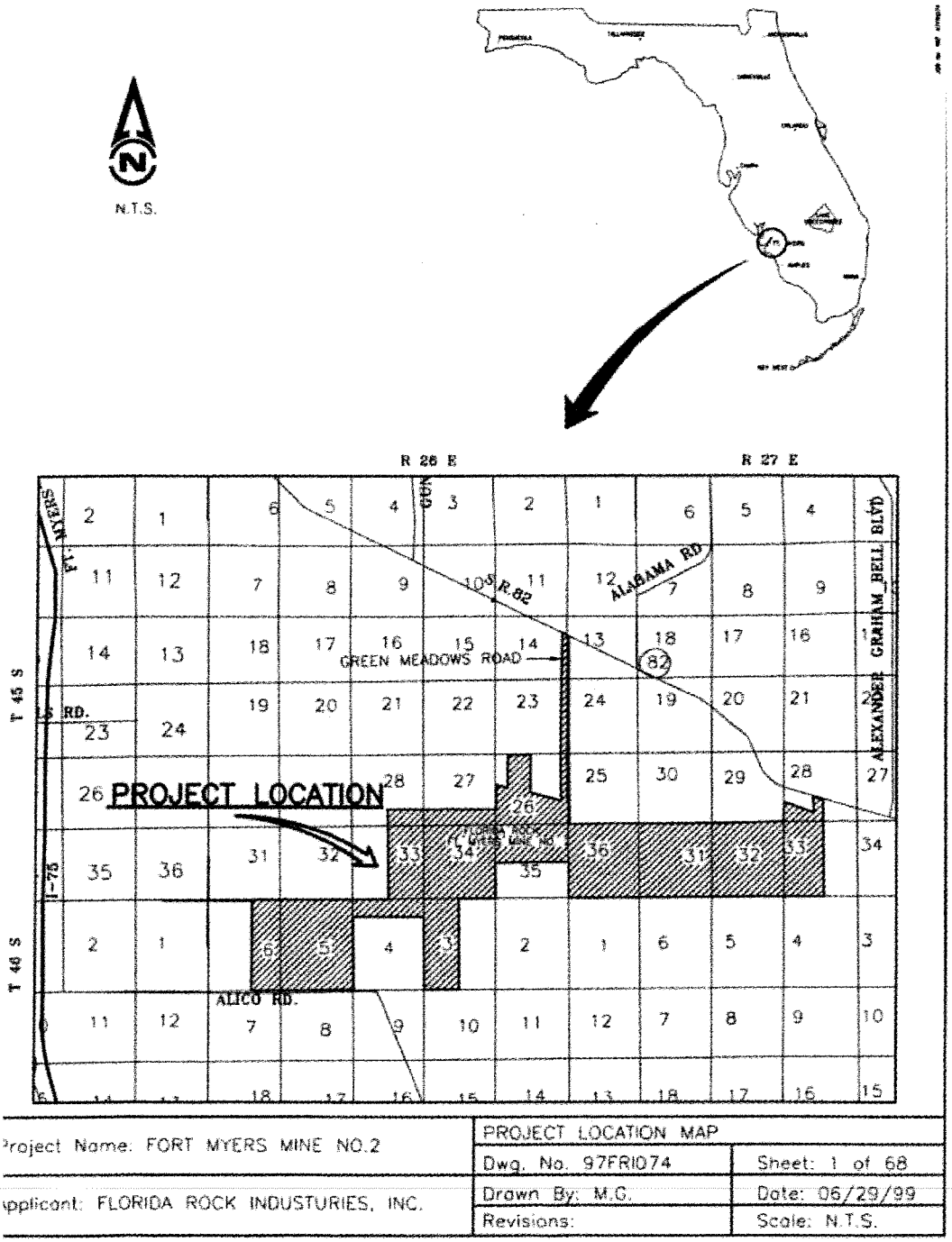


Figure 1 Site of the proposed action, Fort Myers Mine #2, in Lee County, FL.

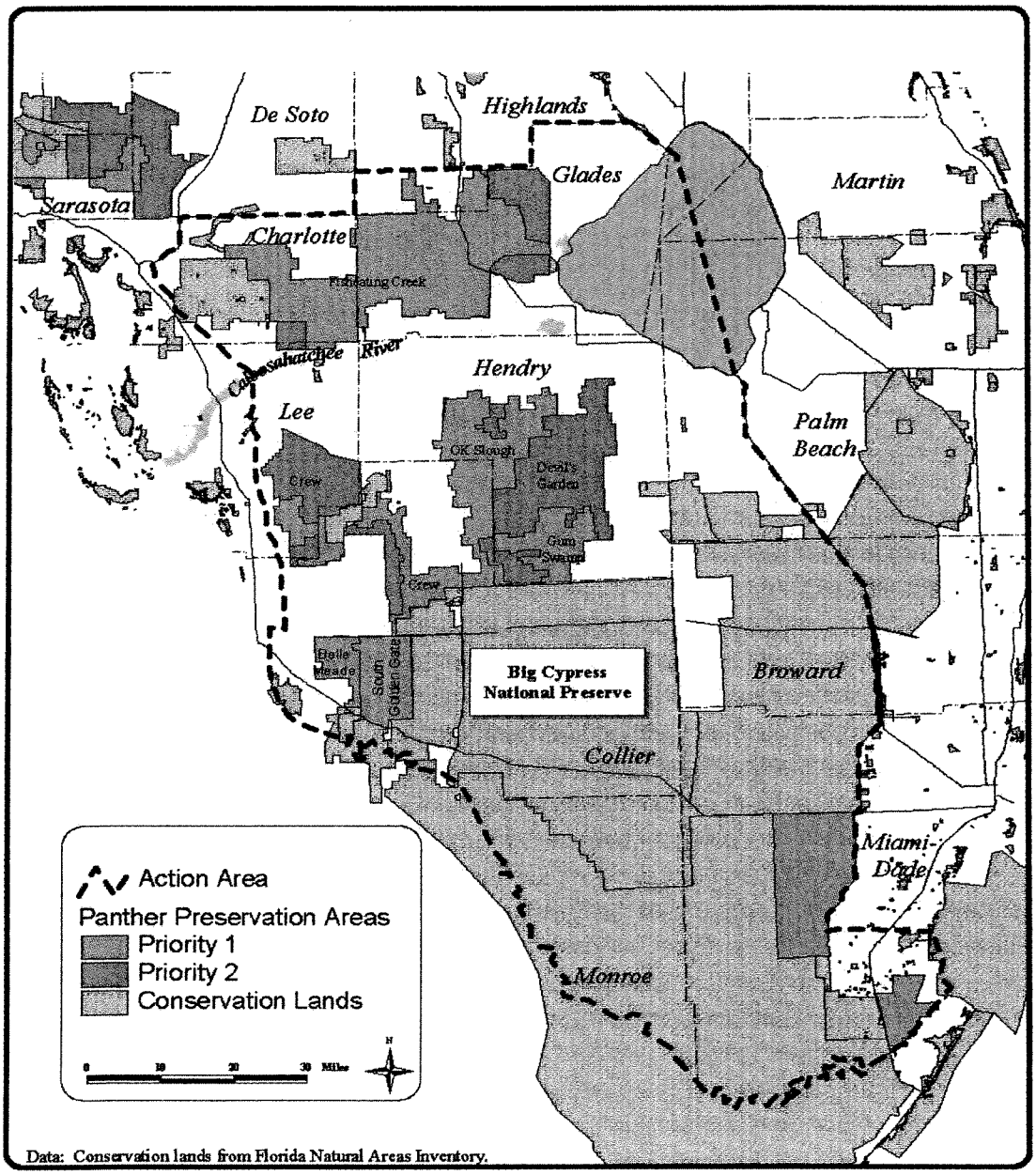


Figure 2. Florida Panther section 7 consultation action area.

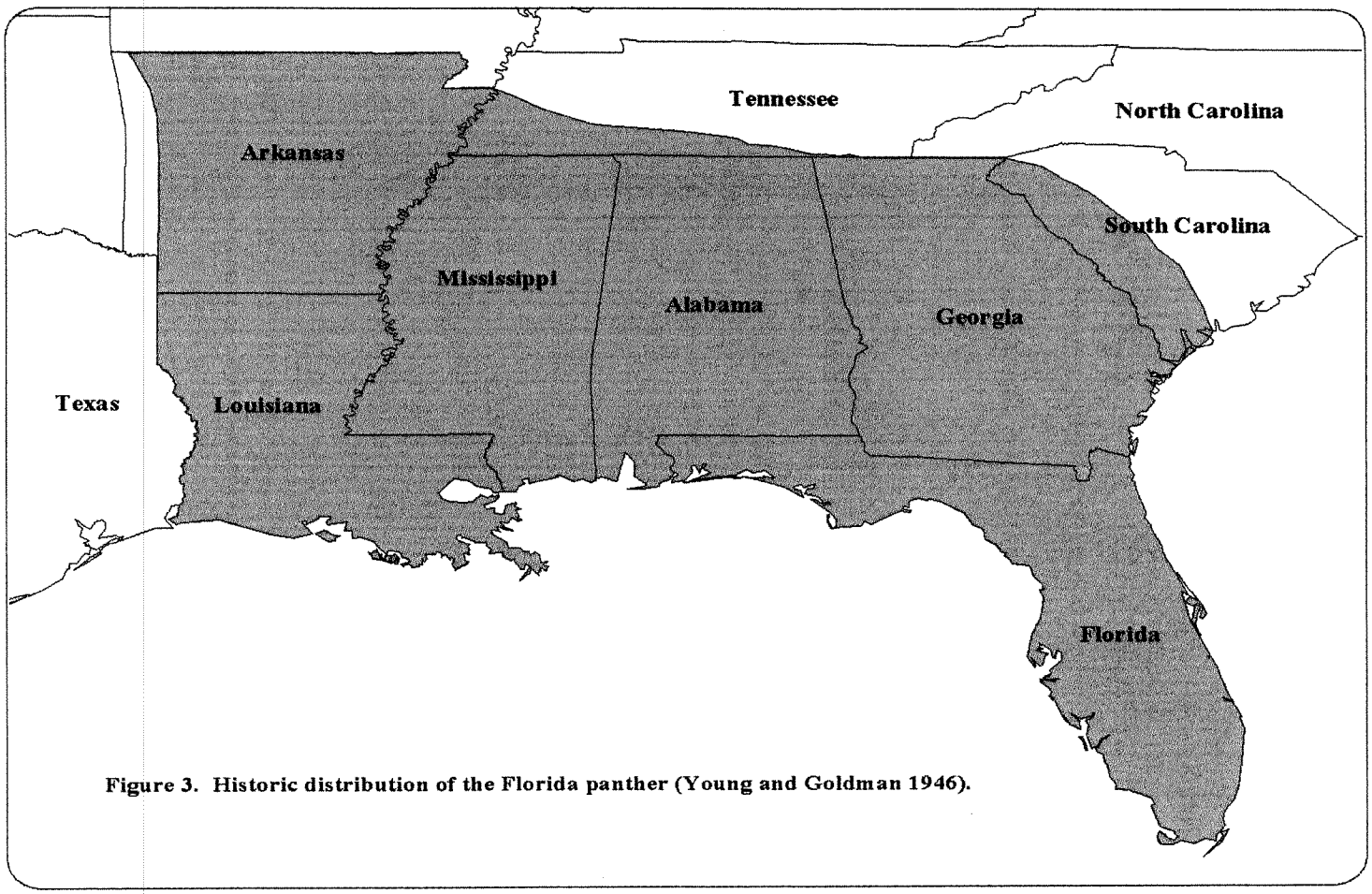
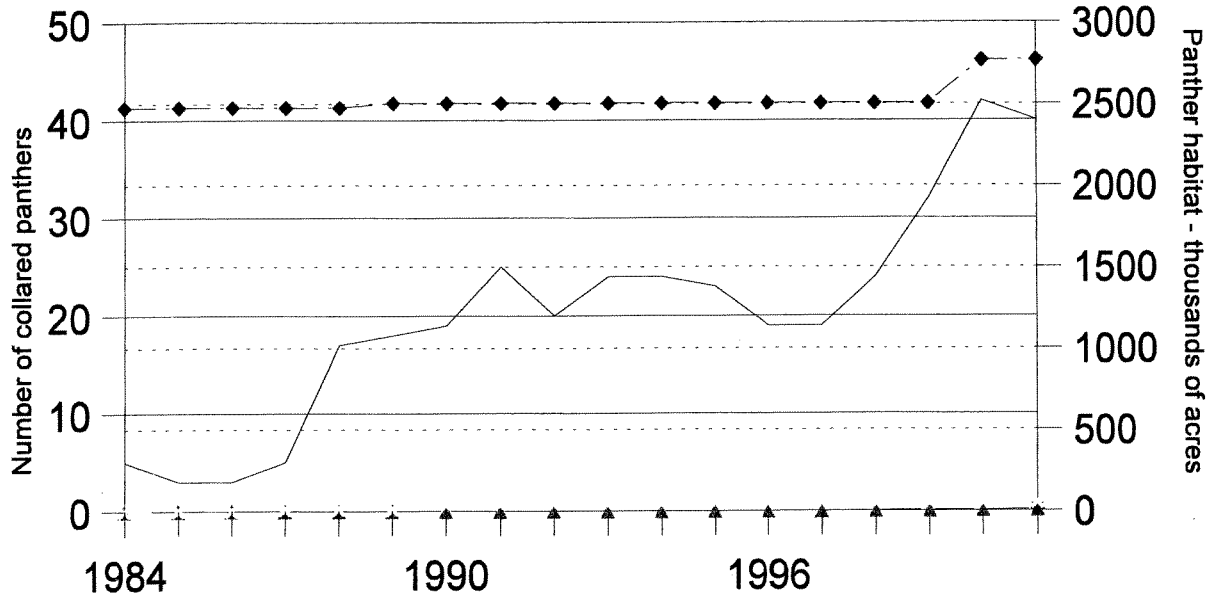


Figure 3. Historic distribution of the Florida panther (Young and Goldman 1946).

Figure 4. Trends in Number of Collared Panthers and Panther Habitat



LITERATURE CITED

Ackerman, B.B. 1982. Cougar predation and ecological energetics in southern Utah. M.S. Thesis, Utah State University, Logan, Utah *in* F.G. Van Dyke, R.H. Brocke, H.G. Shaw, B.B. Ackerman, T.P. Hemker, F.G. Lindzey. 1986. Reactions of mountain lions to logging and human activity. J. Wildlife Management 50(1):95-102.

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

Barone, M.A., M.E. Roelke, J. Howard, J.L. Brown, A.E. Anderson, and D.E. Wildt. 1994. Reproductive characteristics of male Florida panthers: comparative studies from Florida, Texas, Colorado, Latin America, and North American zoos. Journal of Mammalogy 75(1):150-172.

Belden, R.C. 1977. If you see a panther. Florida Wildlife. September-October 1977.

Belden, R.C. 1986. "Florida Panther Recovery Plan Implementation - A 1983 Progress Report", pp. 159-172 in S.D. Miller and D.D. Everett (eds.), Cats of the world: Biology, Conservation and Management, Proceedings of the Second International Cat Symposium. Caesare Kleberg Wildlife Reserarch Institute. Kingsville, Texas.

Belden, R.C. 1988. "The Florida Panther" in Audubon Wildlife Report. 1988/1989. National Audubon Society, New York, NY. 515-532.

Belden, R.C., W.B. Frankenberger, R.T. McBride, and S.T. Schwikert. 1988. Panther habitat use in southern Florida. Journal of Wildlife Management 52(4):660-663.

Belden, R.C., and B.W. Hagedorn. 1993. Feasibility of translocating panthers into northeast Florida. Journal of Wildlife Management 57(2):338-397.

Belden, R.C., and J.W. McCown. 1996. Florida panther reintroduction feasibility study. Final report, July 1, 1992 to June 30, 1995. Study Number 7507, Florida Game and Fresh Water Fish Commission, Tallahassee, Florida.

Cory, C.B. 1896. Hunting and fishing in Florida. Estes and Lauriat. Boston, Massachusetts.

Dees, C.S., J.D. Clark and F. T. van Manen. 1999. Florida panther habitat use in response to prescribed fire at Florida Panther National Wildlife Refuge and Big Cypress National Preserve. Final Report. University of Tennessee, Knoxville, Tennessee.

Duever, M.J., J.E. Carlson, J.F. Meeder, L.C. Duever, L.H. Gunderson, L.A. Riopelle, T.R. Alexander, R.F. Myers, and D.P. Spangler. 1979. Resource inventory and analysis of the Big Cypress National Preserve. Final Report to the National Park Service, University of Florida, Gainesville, and National Audubon Society Ecosystem Research Unit, Naples, Florida. 2 volumes.

Hall, E.R. 1981. The mammals of North America Volume II. The Ronald Press Company; New York, New York.

Harlow, R.F. 1959. An evaluation of white-tailed deer habitat in Florida. Florida Game and Fresh Water Fish Commission. Tech. Bull. 5:1-64.

Harris, L.D. 1985. The fragmented forest. University of Chicago Press; Chicago, Illinois.

Janis, M.W. and J.D. Clark. 1999. The effects of public use on the behavior of Florida panthers at Big Cypress National Preserve. University of Tennessee, Knoxville, Tennessee.

Jordan, D.B. 1997. Telephone communication. January 9, 1997.

Kautz, R.S. 1993. Trends in Florida wildlife habitat 1936-1987. Florida Scientist 56(1):7-24.

Kautz, R.S. 1994. Historical Trends Within the Range of the Florida Panther *in* Proceedings of the Florida Panther Conference, Dennis B. Jordan, Editor. Florida Panther Interagency Committee, November 1-3, 1994.

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

Land, E.D. and S.K. Taylor. 1998. Florida panther genetic restoration and management. Annual report, Study Number 7508. Florida Game and Fresh Water Fish Commission, Tallahassee, Florida.

Land, E.D., M. Lotz, D. Shindle, and S.K. Taylor. 1999. Florida panther genetic restoration and management. Annual report, Study Number 7508. Florida Fish and Wildlife Conservation Commission, Tallahassee, Florida.

Land, E.D., M. Lotz, and D. Shindle. 2000. Florida panther genetic restoration and management. Annual report, Study Number 7500. Florida Fish and Wildlife Conservation Commission, Tallahassee, Florida.

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

Lasley, M.F.W. 1978. Genetics of livestock improvement. Third ed. Prentice-Hall, Englewood Cliffs, New Jersey.

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

Lotz, M.A., E.D. Land, and K.G. Johnson. 1996. Evaluation of State Road 29 wildlife crossings. Final Report, Study No. 7853. Florida Game and Fresh Water Fish Commission, Tallahassee, Florida.

Maehr, D.S. 1989. Florida panther road mortality prevention. Final Performance Report, Study No. 7502. Florida Game and Fresh Water Fish Commission, Tallahassee, Florida.

Maehr, D.S. 1990a. Florida panther movements, social organization, and habitat utilization. Final Performance Report, Study No. 7502. Florida Game and Fresh Water Fish Commission, Tallahassee, Florida.

Maehr, D.S. 1990b. The Florida panther and private lands. Conservation Biology 4 (2):167-170.

Maehr, D.S. 1992a. Florida panther. *In* Rare and Endangered Biota of Florida. Volume I: Mammals. S. R. Humphrey, (ed.). University Press of Florida, Gainesville, Florida.

Maehr, D.S. 1992b. Florida panther distribution and conservation strategy. Final Report, Study No. 7572. Florida Game and Fresh Water Fish Commission, Tallahassee, Florida.

Maehr, D.S. 1993. Response to the wild Florida panther population to removals for captive breeding. Final Report, Study No. 7571. Florida Game and Fresh Water Fish Commission, Tallahassee, Florida.

Maehr, D.S. 1997. The comparative ecology of bobcat, black bear, and Florida panther in south Florida. Bulletin of the Florida Museum of Natural History. University of Florida, Gainesville, Florida.

Maehr, D.S. and J.A. Cox. 1995. Landscape features and panthers in Florida. Conservation Biology: 9(5): 1008-1019.

Maehr, D.S., J.C. Roof, E.D. Land, and J.W. McCown. 1989a. First reproduction of a panther (*Felis concolor coryi*) in Southwest Florida. U.S.A. Mammalia 25:37-38.

Maehr, D.S., E.D. Land, J.C. Roof, and J.W. McCown. 1989b. Early maternal behavior in the Florida panther (*Felis concolor coryi*). Am. Midl. Nat. 122:34-43.

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

Maehr, D.S., E.D. Land, J.C. Roof, and J.W. McCown. 1990b. Day beds, natal dens, and activity of Florida panthers. Proceedings of the Annual Conference of Southeast Fish and Wildlife Agencies 44:000-000.

Maehr, D.S., E.D. Land, and J.C. Roof. 1991a. Social ecology of Florida panthers. National Geographic Research & Exploration 7 (4):414-431.

Maehr, D.S., E.D. Land, and M.E. Roelke. 1991b. Mortality patterns of panthers in southwest Florida. Proceedings of the Annual Conference of Southeastern Association of Fish and Wildlife Agencies 45:201-207.

Maehr, D.S., R.C. Lacey, E.D. Lande, O.L. Bass, and T.S. Hoctor. 1999. A reassessment of Florida panther population viability analysis and recovery efforts from multiple perspectives. Paper presented at Population Viability Analysis: Assessing Models for Recovering Endangered Species. University of California, Berkeley and The Wildlife Society. San Diego, California. March 15-16, 1999.

Mazzotti, F.J., L.A. Brandt, L.G. Pearlstine, W.M. Kitchens, T.A. Obreza, F.C. Depkin, N.E. Morris, and C.E. Arnold. 1992. An evaluation of the regional effects of new citrus development on the ecological integrity of wildlife resources in southwest Florida. Final report. South Florida Water Management District; West Palm Beach, Florida.

McBride, R.T. 1976. The status and ecology of the mountain lion, Felis concolor stanleyana, of the Texas-Mexico border. M.S. Thesis, Sul Ross State University, Alpine; Texas.

McBride, R.T. 2001. Personal communication. November 2001.

O'Brien, S.J., M.E. Roelke, L. Marker, A. Newman, C.A. Winkler, D. Meltzer, L. Colly, J.F. Evermann, M. Bush, and D.E. Wildt. 1985. Genetic basis for species vulnerability in the cheetah. Science 227:1428-1434.

Rails, K., and J. Ballou. 1982. Effects of inbreeding on infant mortality in captive primates. International Journal of Primatology 3:491-505.

Roelke, M.E. 1990. Florida panther biomedical investigations. Final Performance Report, July 1, 1986 - June 30, 1990. Study No. 7506. Florida Game and Fresh Water Fish Commission, Tallahassee, Florida.

Roelke, M.E. 1991. Florida panther biomedical investigation. Annual Performance Report, July 1, 1990-June 30, 1991. Study No. 7506. Florida Game and Fresh Water Fish Commission, Tallahassee, Florida.

Roelke, M.E., J.S. Martenson, and S.J. O'Brien. 1993. The consequences of demographic reduction and genetic depletion in the endangered Florida panther. Current Biology 3:340-350.

Roof, J.C. and D.S. Maehr. 1988. Sign surveys for Florida panthers on peripheral areas of their known range. Florida Field Naturalist. 16:81-85.

Schemnitz, S.D. 1972. Distribution and abundance of alligator, bear, deer, and panther in the Everglades Region of Florida. Report to the Florida Game and Fresh Water Fish Commission, Ft. Lauderdale, Florida in fulfillment of contract No. 14-16-0004-308.

Seal, U.S., R.C. Lacy, and Workshop Participants. 1989. Florida panther viability analysis and species survival plan. Report to the U.S. Fish and Wildlife Service, by the Conservation Breeding Specialist Group, Species Survival Commission, IUCN; Apple Valley, Minnesota.

Seal, U.S., R.C. Lacy, and Workshop Participants. 1992. Genetic management strategies and population viability of the Florid panther. Report to the U.S. Fish and Wildlife Service, by the Conservation Breeding Specialist Group, Species Survival Commission, IUCN; Apple Valley, Minnesota.

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

Service (U.S. Fish and Wildlife Service). 1967. Endangered and threatened wildlife. *Federal Register* Vol. 32: 4001. March 11, 1967.

Service (U.S. Fish and Wildlife Service). 1987. Habitat management guidelines for the bald eagle in the southeast region; Atlanta, Georgia.

Service (U.S. Fish and Wildlife Service). 1987. Florida Panther (*Felis concolor coryi*) recovery plan. Prepared by the Florida panther interagency committee for the U. S. Fish and Wildlife Service; Atlanta, Georgia.

Service (U.S. Fish and Wildlife Service). 1994. Final Environmental Assessment - Genetic restoration of the Florida panther; Atlanta, Georgia.

Service (U.S. Fish and Wildlife Service). 1995. Second revision Florida panther recovery plan; Atlanta, Georgia.

Service (U.S. Fish and Wildlife Service and National Marine Fisheries Service). 1998. Endangered Species Act consultation handbook: procedures for conducting section 7 consultations and conferences; Washington, D.C.

Service (U.S. Fish and Wildlife Service). 1999. Multi-species recovery plan for south Florida. U.S. Fish and Wildlife Service, Vero Beach, Florida.

South Florida Water Management District (SFWMD). 1996. Basis of review for Environmental Resource Permit applications within the South Florida Water Management District. West Palm Beach, Florida.

Southwest Florida Regional Planning Council (SWFRPC). 1995. Strategic Regional Policy Plan of the Southwest Florida Regional Planning Council. North Fort Myers, Florida.

Smith, G. 1970. Mystery cat. Florida Wildlife 24 (3):4-6.

Terborgh, J. 1988. The big things that run the world - a sequel to E. O. Wilson. Conservation Biology 2:402-403.

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

Townsend, D. 1991. An economic overview of the agricultural expansion in southwest Florida. Unpublished report on file at South Florida Field Office, U.S. Fish and Wildlife Service, Vero Beach, Florida.

Townsend, D. 2001. Personal communication. December 10, 2001.

U.S. Department of the Interior [DOI]. 1969. Environmental impact statement of the Big Cypress Swamp jetport. Washington, D.C.

Van Dyke, F.G. 1983. A western study of cougar track surveys and environmental disturbances affecting cougars related to the status of the eastern cougar *Felis concolor couguar*. Ph.D. Thesis, State University, New York, Syracuse *in* F.G. Van Dyke, R.H. Brocke, H.G. Shaw, B.B. Ackerman, T.P. Hemker, F.G. Lindzey. 1986. Reactions of mountain lions to logging and human activity. J. Wildlife Management 50(1):95-102.

Van Dyke, F.G., R.H. Brocke, H.G. Shaw, B.B. Ackerman, T.P. Hemker, F.G. Lindzey. 1986. Reactions of mountain lions to logging and human activity. J. Wildlife Management 50(1):95-102.

Wildt, D.E., E.J. Baas, P.K. Chakraborty, T.L. Wolfle, and A.P. Stewart. 1982. Influence of inbreeding on reproductive performance, ejaculate quality and testicular volume in the dog. Theriogenology 17:445-452.

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

bc:Reading
AEller:alp:1/30/02(R:\2002\January 2002\4198f372.fin.wpd)