Biological Opinion and Conference Opinion

Eastern Collier Multi-Species Habitat Conservation Plan

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CONSULTATION HISTORY

The review of the East Collier Multi-Species Habitat Conservation Plan (HCP) for Incidental Take Permit (ITP) decisions under Endangered Species Act (ESA) §10(a)(1)(B) involved three offices of the U.S. Fish and Wildlife Service (Service):

- South Florida Ecological Services Field Office (SFESO);
- Southeast Regional Office, Ecological Services (RO); and
- Program Supervisor for Ecological Services in Florida (Florida State Office, or FSO).

The SFESO provided technical assistance to the East Collier Property Owners (ECPO, or the Applicants) during the development of their HCP and applications for ITPs. The Deputy Regional Director in the RO has the authority to issue ITPs in the Service's Southeast Region. The RO assigned the role of consulting office for this intra-Service consultation under ESA §7(a)(2) to the FSO, which is responsible for the findings reported in this Biological Opinion and Conference Opinion (BO/CO). Service biologists of the SFESO and the RO contributed to the supporting analyses for the findings documented herein.

The SFESO holds the record of technical assistance with the Applicants prior to receipt of the final version of the HCP. The FSO holds the record of this consultation, *i.e.,* all data and documents supporting this opinion. The RO holds the record of the pending decisions for the ITP applications, including the record of compliance with the National Environmental Policy Act (NEPA).

The following chronological list identifies key events in the evolution of the HCP, NEPA compliance, and the formulation of this BO/CO.

May 20, 2009 – ECPO informed the Service of its intention to prepare an HCP and seek Incidental Take Permits (ITPs).

June 3, 2010 – ECPO members became the Applicants by submitting a draft Habitat Conservation Plan (HCP) summary and ITP Applications.

July 5, 2010 – Service acknowledged receipt of the HCP summary and ITP applications, informing the Applicants that:

- their applications are considered incomplete until the HCP satisfies all statutory requirements; and
- the Service will likely need to prepare an Environmental Impact Statement (EIS).

March 15, 2012 – Service and Applicants met to discuss the status of the HCP.

April 21, 2015 – Applicants submitted a draft HCP.

October 6, 2015 – Service provided preliminary comments on the HCP.

March 14–17, 2016 – Service met with the Applicants to visit the Plan Area and to discuss the HCP.

March 25, 2016 – Service published in the Federal Register a Notice of Intent (NOI) to prepare an EIS, requesting public comments within 30 days (81 FR 16200).

April 12, 2016 – Service held a public scoping meeting to inform interested parties about the EIS.

April 19, 2016 – Service held an on-line inter-agency scoping meeting to inform interested agencies about the EIS, to which other interested parties from the public could listen.

April 25, 2016 – Comment period for the NOI closed.

May 16, 2016 – Service requested the U.S. Army Corps of Engineers (Corps) participation as a Cooperating Agency in the EIS process.

May 17, 2016 – Service met with the Applicants to discuss EIS public scoping comments and HCP comments.

May 25, 2016 – U.S. Army Corps of Engineers (Corps) agreed to serve as a Cooperating Agency.

April 26, 2017 – Service and Applicants met to discuss the HCP.

April 27, 2017 – Department of the Interior (DOI) issued Secretarial Order (SO) 3355, which directed all bureaus to complete an EIS-supported decision within 1 year of publishing the NOI.

August 11, 2017- The Service advised ECPO that consultation for the red knot (*Calidris canutus rufa*) would be necessary.

August 31, 2017 – DOI provided additional information for implementing SO 3355.

October 24, 2017 – Applicants submitted a revised HCP.

December 11, 2017 – Service met with the Applicant’s consultant to discuss deconstruction of the activities described in the HCP.

February 28, 2018 – Service and Applicants met to visit the Plan area.

March 1, 2018 – Service and the Applicants met to discuss the HCP.

April 6, 2018 – Applicants submitted a revised HCP.

April 23, 2018 – Applicants submitted a revised HCP.

May 23, 2018 – Service and Applicants conducted a site visit of the HCP area.

June 13, 2018 – Service provided comments to the Applicants on the draft HCP.

August 2, 2018 – Applicants submitted a revised HCP.

September 14, 2018 – Service briefed DOI officials about the draft EIS and requested permission to publish a Notice of Availability (NOA) in the Federal Register.

September, 2018 – The RO assigned responsibility for the intra-Service BO/CO to the Panama City, FL, Field Office.

October 10, 2018 – Hurricane Michael devastated Panama City and other areas, which precluded the Panama City Field Office from working further on the East Collier HCP BO/CO. The RO subsequently reassigned responsibility for the BO/CO to the FSO.

October 19, 2018 – Service published a NOA for the draft EIS in the Federal Register, requesting public comments within 45 days (83 FR 53078–53080).

December 3, 2018 – Comment period for the NOA closed.

December 22, 2018–January 25, 2019 – Furlough for all non-essential Service personnel, which suspended all work related to the East Collier ITPs.

March 8, 2019 – Applicants submitted a revised HCP.

March 25, 2019 – Applicants submitted a revised HCP.

April 1, 2019 – DOI granted the Service a 60-day extension of the SO 3355 deadline for reaching a decision on the ITPs.

June 5, 2019 – Service placed the project on pause with respect to the SO 3355 deadline for reaching a decision on the ITPs to allow ECPO to review and comment on the BO/CO traffic analyses.

August 27, 2019 – Service published revised section 7 regulations.

September 10, 2019 – The RO received a complete application from the 12th Applicant (Gargiulo, Inc. Application # TE54442D-0).

December 10, 2019 – The Service completed an update of the BO/CO to reflect the revised section 7 regulations.

January 23, 2020 – Service published a NOA for the draft EIS in the Federal Register to inform the public about the addition of the 12th Applicant and requested comments within 30 days (85 FR 3941-3943).

January 28, 2020 – ECPO sent a new Plan Area map after changing some development acreages to preserve acreages to expand the northern corridor.

February 21, 2020 – Comment period for the NOA closed.

May 11, 2020 – BO/CO circulated for internal Service review.

May 21, 2020 – Service ended the pause on the SO 3355 deadline for reaching a decision on the ITPs.

June 10, 2020 – Proposed critical habitat for the Florida bonneted bat was noticed in the Federal Register for a 60-day comment period.

June 26, 2020 – An analysis of effects of the HCP on Florida bonneted bat proposed critical habitat was incorporated into the BO/CO.

June 26, 2020 – Service sent BO/CO to Regional Solicitor's Office for review.

July 27, 2020 – Regional Solicitor's Office provided comments on the BO/CO.

BIOLOGICAL OPINION and CONFERENCE OPINION

1 INTRODUCTION

A biological opinion (BO) is the document that states the opinion of the U.S. Fish and Wildlife Service (Service) under section 7 of the Endangered Species Act of 1973, as amended (ESA), as to whether a Federal action is likely to:

- jeopardize the continued existence of species classified as endangered or threatened; or
- result in the destruction or adverse modification of designated critical habitat.

The proposed Federal action addressed in this BO is the Service's issuance of Incidental Take Permits (ITPs) to the proponents (Applicants) of the Eastern Collier Multiple Species Habitat Conservation Plan (HCP) (the Action). This document is also a conference opinion (CO) that applies the analytical framework of a BO to the review of Action effects on species covered in the HCP that are not classified at present as endangered or threatened and to proposed critical habitat.

The HCP describes "Covered Activities" for which the proponents seek incidental take authorization on lands located in the northeast corner of Collier County (Figure 1-1) (note: with some exceptions, tables and figures in this BO/CO appear in a separate section that follows the major section in which we reference them). These activities may occur on designated portions of a 159,489-acre area owned mostly by the Applicants, but also by other parties (collectively, the Plan Area). We more fully describe the Plan Area and the Action Area (all areas to be affected by the Covered Activities) for this consultation in section 2.1 (the Glossary in the Appendix A explains these and other terms used throughout this document).

The Service evaluated the likely effects to the natural, physical, and human environments resulting from the issuance of ITPs for the Covered Activities in a Draft Environmental Impact Statement (EIS) (USFWS 2018) released October 19, 2018 (notice of availability 83 FR 53078-53080). The EIS discloses the environmental impacts of no action, the proposed action, and reasonable alternatives to the proposed action. The Service will consider the EIS and public comments in making its decision whether to issue ITPs for the proposed HCP. This BO/CO evaluates only the proposed action (issuance of ITPs for the HCP as proposed) for compliance with ESA §7(a)(2), which is a permit issuance criterion among several. The Service received several iterations of the HCP from the Applicants during the course of its development (see Consultation History), most recently on January 28, 2020. This latest version of the HCP provides the description of the Covered Activities that prompt the Federal Action we evaluate in this BO/CO.

The Applicants for this Federal Action are the following twelve landowners, collectively known as the Eastern Collier Property Owners, LLC (ECPO):

Owner	Application #
Alico Land Development, Inc.	TE05647D-0
Barron Collier Companies	TE04440D-0
Collier Enterprises Management, Inc.	TE04443D-0

Consolidated Citrus Limited Partnership	TE04471D-0
English Brothers Partnership	TE04152D-0
Gargiulo, Inc.	TE54442D-0
Half Circle L Ranch, LLP	TE05238D-0
Heller Bros. Packing Corp.	TE05668D-0
JB Ranch I, LLC (formerly John E. Price, Jr. Trust)	TE04473D-0
Owl Hammock Immokalee LLC	TE06114D-0
Pacific Land, Ltd.	TE05665D-0
Sunniland Family Limited Partnership	TE04472D-0

The Service will disclose its decision under ESA §10(a)(1)(B) whether to issue the requested ITPs in a separate findings memorandum that will rely, in part, on the findings of this BO/CO, including its estimation of the amount or extent of anticipated incidental take for each species and whether proposed critical habitat is adversely modified.

The Applicants prepared the HCP with technical assistance from the Service's South Florida Ecological Services Office (SFESO). An HCP must describe:

- the impacts of the proposed activities that require take authorization;
- the measures proposed to minimize and mitigate such impacts;
- the funding available to implement such measures;
- alternatives considered to the activities that require take authorization and the reasons for not adopting such alternatives; and
- other measures that the Service may require as necessary or appropriate for purposes of the plan.

An ITP authorizes the take caused by Covered Activities described in an HCP, not the Covered Activities themselves. This BO/CO analyzes the likely effects of the Covered Activities on the Covered Species, which we identify in the following section. The Deputy Regional Director of Service's Southeast Regional Office (RO) is the official responsible for deciding whether to issue ITPs for the proposed HCP. The RO requested the Florida State Supervisor for Ecological Services in Florida (Florida State Office, or FSO), who oversees the SFESO and two other Field Offices, to independently review the Action for compliance with ESA §7(a)(2), which is a permit issuance criterion. For this intra-Service consultation and conference, the RO is proposing the Federal Action, and the Florida State Office is providing the opinion for the Action.

1.1 Covered Species

ESA §9(a)(1) and regulations issued under §4(d) prohibit the take of endangered and threatened fish and wildlife species without special exemption. The term "take" in the ESA means "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" (ESA §3). The Applicants request that the Service authorize take of 8 ESA-protected species, and prospectively address take of 11 species that are not presently protected under the ESA, that is incidental to (not the purpose of) activities proposed under the HCP. Table 1-1 identifies these species.

Table 1-1. Species assessed in the proposed HCP.

Common Name	Scientific Name	Status[a]
Mammals		
Florida bonneted bat	*Eumops floridanus*	F-E
Everglades mink	*Neovison vison evergladensis*	S-T
Florida panther	*Puma concolor coryi*	F-E
Big Cypress fox squirrel	*Sciurus niger avicennia*	S-T
Birds		
Florida sandhill crane	*Antigone canadensis pratensis*	S-T
Florida scrub jay	*Aphelocoma coerulescens*	F-T
Florida burrowing owl	*Athene cunicularia floridana*	S-T
Little blue heron	*Egretta caerulea*	S-T
Tricolored heron	*Egretta tricolor*	S-T
Southeastern American kestrel	*Falco sparverius paulus*	S-T
Wood stork	*Mycteria americana*	F-T
Red-cockaded woodpecker	*Picoides borealis*	F-E
Roseate spoonbill	*Platalea ajaja*	S-T
Audubon's crested caracara	*Polyborus plancus*	F-T
Everglade snail kite	*Rostrhamus sociabilis plumbeus*	F-E
Reptiles		
Eastern diamondback rattlesnake	*Crotalus adamanteus*	F-Under Review
Eastern indigo snake	*Drymarchon corais couperi*	F-T
Gopher tortoise	*Gopherus polyphemus*	F-C
Gopher frog	*Lithobates capito*	F-Under review

[a] F = Federal; S = State of Florida; E = endangered; T = threatened; C = candidate

The Service has reliable information that an additional ESA-listed species, the red knot (*Calidris canutus rufa*) (threatened), seasonally uses portions of the HCP area that are proposed for development. Although the SFESO advised the Applicants of this information on August 11, 2017, the HCP does not assess effects to this species. The Service may not issue a permit for an action that may affect a listed species without demonstrating compliance with ESA §7(a)(2); therefore, this BO/CO includes an analysis of the effects of the proposed HCP on the red knot.

The red knot is not a "Covered Species" for ITP purposes, because the Applicants have not requested incidental take authorization for the red knot. For intra-Service consultation purposes, we include the red knot with the species listed in Table 1-1. Hereafter in this document, unless we indicate otherwise, our use of the term "Covered Species" refers to 20 species collectively: the 19 species listed in Table 1-1 plus the red knot, recognizing that any Service-issued ITPs will not include the red knot.

1.1.1 Species Dismissed from Further Analysis

Our analyses of the 20 Covered Species identified in section 1.1 revealed that three are not reasonably certain to occur in the Plan Area, either presently or in the foreseeable future: gopher frog, Southeastern American kestrel, and Everglades mink. Because these three species are not protected under the ESA, its incidental take prohibitions do not apply. When best available data do not support a determination that a species is likely present in the area that an action will affect, all subsequent steps in effects analysis are moot; therefore, we do not address these species further in this BO/CO. Although the Applicants' request prospective incidental take authorization for these species, the amount or extent of take resulting from the Action as proposed that we anticipate is none. The remainder of this section provides the data and reasoning that support our determination that these species are not present in the Plan Area.

<u>Gopher Frog</u>

Western Collier County is the southwestern limit of the range of the gopher frog (FWC 2013a), which does not include the eastern half of the county (Figure 1-2). Krysko *et al*. (2011) report a single record for gopher frog in Collier County, dated before 1980 and located more than 30 miles west of the Plan Area. Humphries and Sisson (2012) report that gopher frogs may travel distances of up to 3 miles for breeding purposes; therefore, dispersal into the Plan Area from more distant occupied areas is unlikely. The Applicants did not conduct surveys designed to detect gopher frogs, and do not report in the HCP any records of the species from the Plan Area. We have no data that suggest the range of the gopher frog is likely to expand to the south or east into the Plan Area during the foreseeable future.

<u>Southeastern American Kestrel</u>

The Southeastern American kestrel is closely associated with longleaf pine/wiregrass communities, which do not occur in the Plan Area. Although this subspecies of the American kestrel will use other habitat types that are present in the Plan Area, Collier County is outside its current breeding range (FWC 2013b). The nearest known population inhabits the Lake Wales Ridge, outside of the Action Area (Figure 1-3). The nearest confirmed breeding location was recorded along the Caloosahatchee River on the border of Lee and Hendry Counties, approximately 14 miles north of the Plan Area (FWC 2013b). The subspecies does not migrate seasonally and demonstrates limited dispersal ability, typically less than 5 miles (Miller and Smallwood 1997). The Applicants did not conduct surveys designed to detect the Southeastern American kestrel, and do not report in the HCP any records of the subspecies from the Plan Area. We have no data that suggest the range of the Southeastern American kestrel is likely to expand into the Plan Area during the foreseeable future.

<u>Everglades Mink</u>

The Everglades mink is a south-Florida subspecies of the American mink. The current distribution of the subspecies is poorly understood. FWC (2011) describes its current range and habitat as the shallow freshwater marshes of the Everglades and Big Cypress Swamp regions. The Plan Area is located north of the Everglades mink's estimated distribution (Figure 1-4).

Occurrence records during the past 10 years come from Fakahatchee Strand Preserve State Park, which is 12 miles south of the Plan Area, and the Picayune Strand State Forest, which is west of Fakahatchee Strand (M. Owen, FSPSP, and J. Gore, FWC, personal communication). There have been no recent mink sightings in the Florida Panther National Wildlife Refuge, which borders the Plan Area to the south (C. Winchester, FWC, personal communication). The Applicants did not conduct surveys designed to detect the mink, and do not report in the HCP any records of the subspecies from the Plan Area. We have no data that suggest the current or reasonably foreseeable range of the Everglades mink includes the Plan Area.

1.2 Biological Opinion and Conference Opinion Framework

This BO/CO considers the effects of activities proposed in the Applicants' HCP, for which the Applicants seek take authorization from the Service. The term "take" in the ESA means "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" (ESA §3(19)). In regulations at 50 CFR §17.3, the Service further defines:

- "harass" as "an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering;"
- "harm" as "an act which actually kills or injures wildlife. Such act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering;" and
- "incidental take" as "any taking otherwise prohibited, if such taking is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity."

By memorandum dated April 26, 2018, the Service's Principal Deputy Director issued guidance about the "trigger for an incidental take permit" under ESA §10(a)(1)(B) (https://www.fws.gov/endangered/esa-library/pdf/Guidance-on-When-to-Seek-an-Incidental-Take-Permit.pdf). The requirement for an ITP applies when ESA-prohibited take of wildlife is reasonably certain to occur incidental to, and not the purpose of, otherwise lawful non-Federal activities. The guidance memo clarified that harass is not a form of incidental take permitted under §10(a)(1)(B), because the definition of harass applies to intentional or negligent acts or omissions. Disturbance (*e.g.,* noise, odors, vibrations) that is incidental to an otherwise lawful activity may constitute significant habitat modification under the definition of harm, but is inconsistent with the definition of harass. Our analyses in this BO/CO identify the reasonably certain consequences for the Covered Species caused by activities included in the proposed Action, and by other activities that would not occur but for the proposed Action, and we estimate the amount or extent of take that is incidental to these activities.

The take prohibitions of ESA §9 apply to four species named in Table 1-1 that are classified as endangered. Take prohibitions adopted by regulation under ESA §4(d) apply to another four species named in Table 1-1 that are classified as threatened, plus the red knot. At this time, the protections of the ESA do not extend to the remaining 11 non-listed Covered Species; therefore, a permit that authorizes incidental take of these species is not required under the ESA. However, an applicant's HCP may request the Service to include non-listed species in an ITP for take authorization later during the permit's effective period when the Service may classify such species as endangered or threatened. The Applicants have requested a 50-year permit duration.

The Service may grant prospective take authorization for non-listed species, provided the proposed HCP satisfies the same ITP issuance criteria that apply to listed species. These criteria include a finding that the activities proposed under the HCP are not likely to jeopardize the continued existence of a covered species. This document provides BOs for 9 listed species, and COs for 11 non-listed species, to address this issuance criterion.

"*Jeopardize the continued existence* means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR §402.02). The Service determines in a BO/CO whether we expect an action to satisfy this definition using the best available relevant data in the following analytical framework (see 50 CFR §402.02 for the regulatory definitions of *action, action area, environmental baseline, effects of the action*, and *cumulative effects*).

a. *Proposed Action*. Review the proposed Federal action and describe the environmental changes its implementation would cause, which defines the action area.
b. *Status of the Species*. Review and describe the current range-wide status of the species.
c. *Environmental Baseline*. Describe the condition of the listed species in the action area, without the consequences to the listed species caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impacts of State or private actions which are contemporaneous with the consultation.
d. *Effects of the Action*. Predict all consequences to listed species that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action.
e. *Cumulative Effects*. Predict all consequences to listed species that are caused by future State or private activities, not involving Federal activities, which are reasonably certain to occur within the action area.
f. *Conclusion*. Add the effects of the action and cumulative effects to the environmental baseline and in light of the status of the species, formulate the Service's opinion as to whether the action is likely to jeopardize the continued existence of listed species.

We accomplish step "a" above in section 2 of this BO/CO. In section 3, we provide data about sources of cumulative effects and other information that are common to multiple species-specific analyses. We provide the remaining basis of our opinion for each species identified in section 1.1 (steps "b–f" above) in a separate level-1 section thereafter that addresses the species' status, environmental baseline, effects of the Action, cumulative effects, and conclusion.

ESA §10(a)(1)(B) does not apply to designated CH. However, a Federal action that is likely to destroy or adversely modify designated CH is not lawful; therefore, our CO also evaluates the effects of the Action to proposed CH. Within the areas that are included in the HCP, the Service has proposed CH for the Florida bonneted bat.

"*Destruction or adverse modification*" means a direct or indirect alteration that appreciably diminishes the value of designated CH for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features (PBFs) essential to the conservation of a species or that preclude or significantly delay development of such features (50 CFR §402.02).

A Service opinion that concludes a proposed Federal action is *not* likely to jeopardize species and is *not* likely to destroy or adversely modify critical habitat fulfills the action agency's responsibilities under ESA §7(a)(2).

1.3 Future Federal Actions Related to the Proposed Action

Future Federal actions unrelated to the proposed action are not considered in this BO/CO because they require separate consultation pursuant to section 7 of the Act. Future Federal actions may include activities proposed by landowners of Eligible Lands that choose not to be included in the HCP.

Some of the Applicants' Covered Activities may involve the discharge of dredged or fill material into waters of the United States. Such discharges require a permit from the Corps of Engineers under section 404 of the Clean Water Act of 1977, as amended, ("CWA"), 33 U.S.C. § 1344 ("404 permit"). If the discharge may affect Federally listed species, the Corps must consult with the Service under section 7 of the ESA prior to issuing the permit. The Corps cannot issue a 404 permit if the proposed activity would jeopardize the continued existence of a Federally listed species or result in the adverse modification of a species' designated critical habitat.

Through our review of the HCP, preparation of this BO/CO, and issuance of any ITPs, the Service has analyzed the anticipated impacts on the Covered Species of ITP issuance for the Covered Activities described in the HCP. We expect many of the Covered Activities would require 404 permits in order to lawfully continue, even if we determine that they would not result in jeopardy or adverse modification. Because of the HCP's programmatic approach, we do not know specific plans or locations of the covered activities, so the Corps cannot review wetland impacts at this time.

As the applicants prepare specific project proposals under the HCP, they would apply to the Corps for wetland review and a 404 permit as required by Corps procedures. The Corps would then consult with the Service under section 7 of the ESA. A covered activity, however, would have already received incidental take authority via an ITP. This would negate the need for the Corps to receive exemption for incidental take, but would not excuse the Corps from consulting with the Service, under ESA section 7, for any 404 permit they issue.

In order to avoid duplicative section 7 consultations, the Service and the Corps have prepared a Memorandum of Understanding (MOU) to establish procedures to expedite and streamline future section 7 interagency consultations between the Service and Corps on Applicants' applications for 404 permits associated with the Covered Activities of the HCP. The MOU would be executed after the Service concludes its review of the HCP and only if the Service decides to issue ITPs.

The MOU relies on project-specific coordination between the Service and an Applicant that would be required for any project to be conducted under the HCP. If the Service concurs with an Applicant that a proposed project is consistent with the HCP, it would provide the Applicant written concurrence to that effect.

Under the terms of the MOU, the Service would affirm to the Corps that a concurrence letter issued to an Applicant/Permittee would certify that the proposed project is consistent with the Covered Activities analyzed in this BO/CO and that the Corps may rely on such certification in satisfying its ESA section 7 obligations associated with processing Applicant's 404 permit application.

1.4 Tables and Figures

Figure 1-1. Location of the proposed Eastern Collier Multiple Species Habitat Conservation Plan.

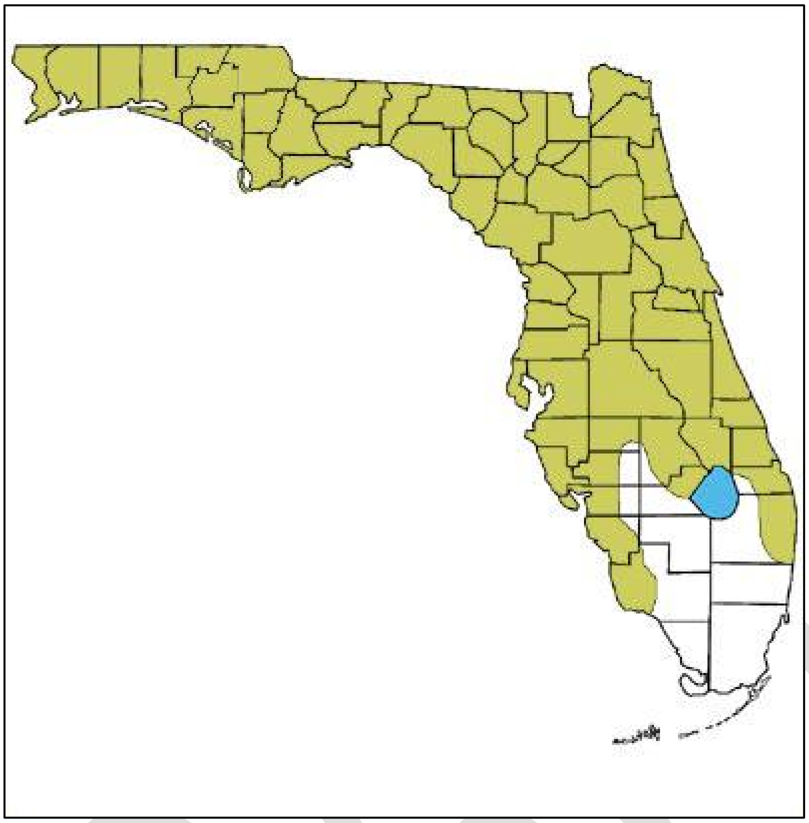


Figure 1-2. Range of the gopher frog in Florida based on historical records and the location of suitable habitat (map credit: Monica McGarrity, University of Florida).

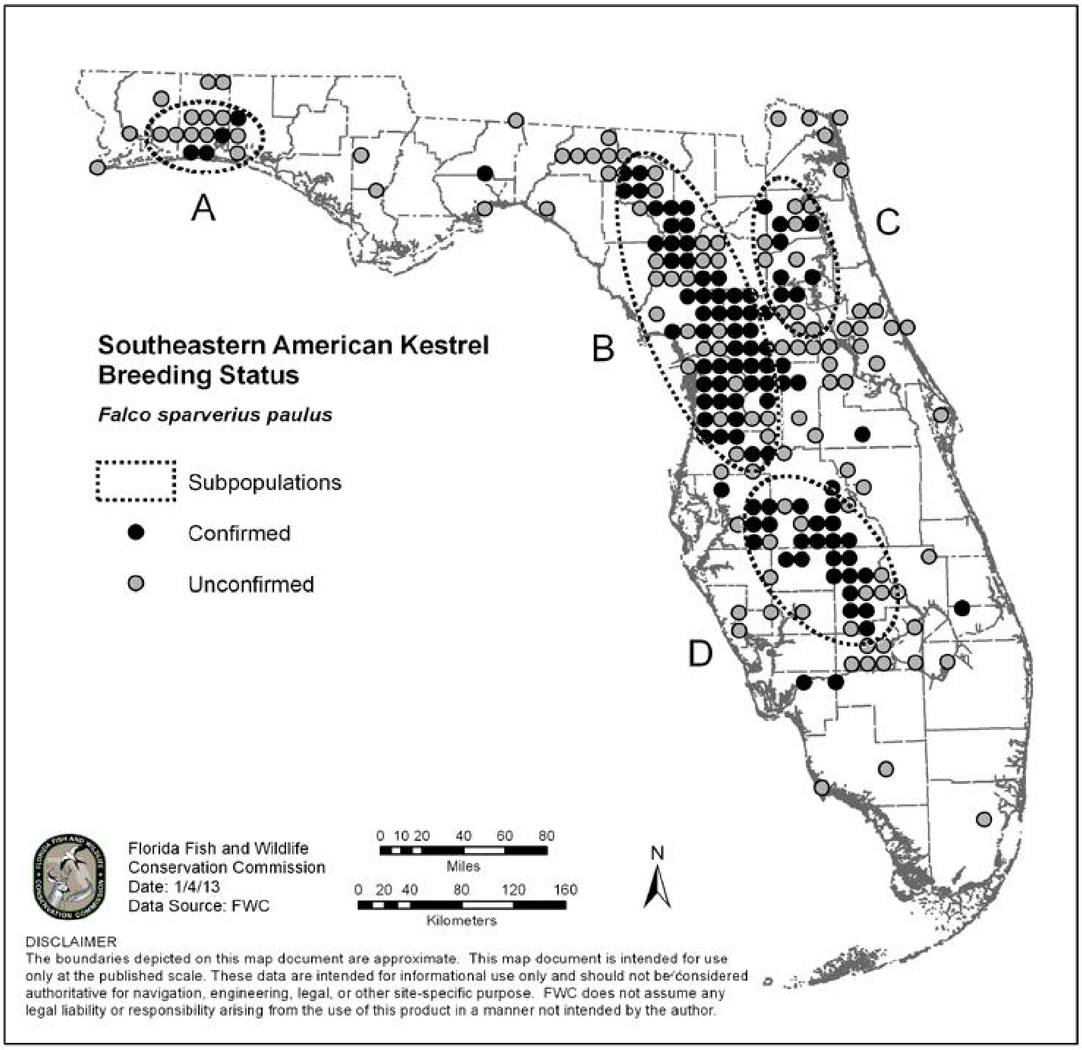


Figure 1-3. Distribution of the Southeastern American kestrel. The four largest regional subpopulations are: (A) Western Panhandle; (B) Brooksville Ridge and vicinity; (C) Trail Ridge and vicinity; and (D) Lake Wales Ridge and vicinity. Points represent locations where breeding activity was recorded during Florida's Breeding Bird Atlas (FWC 2003) (map source: FWC 2013b).

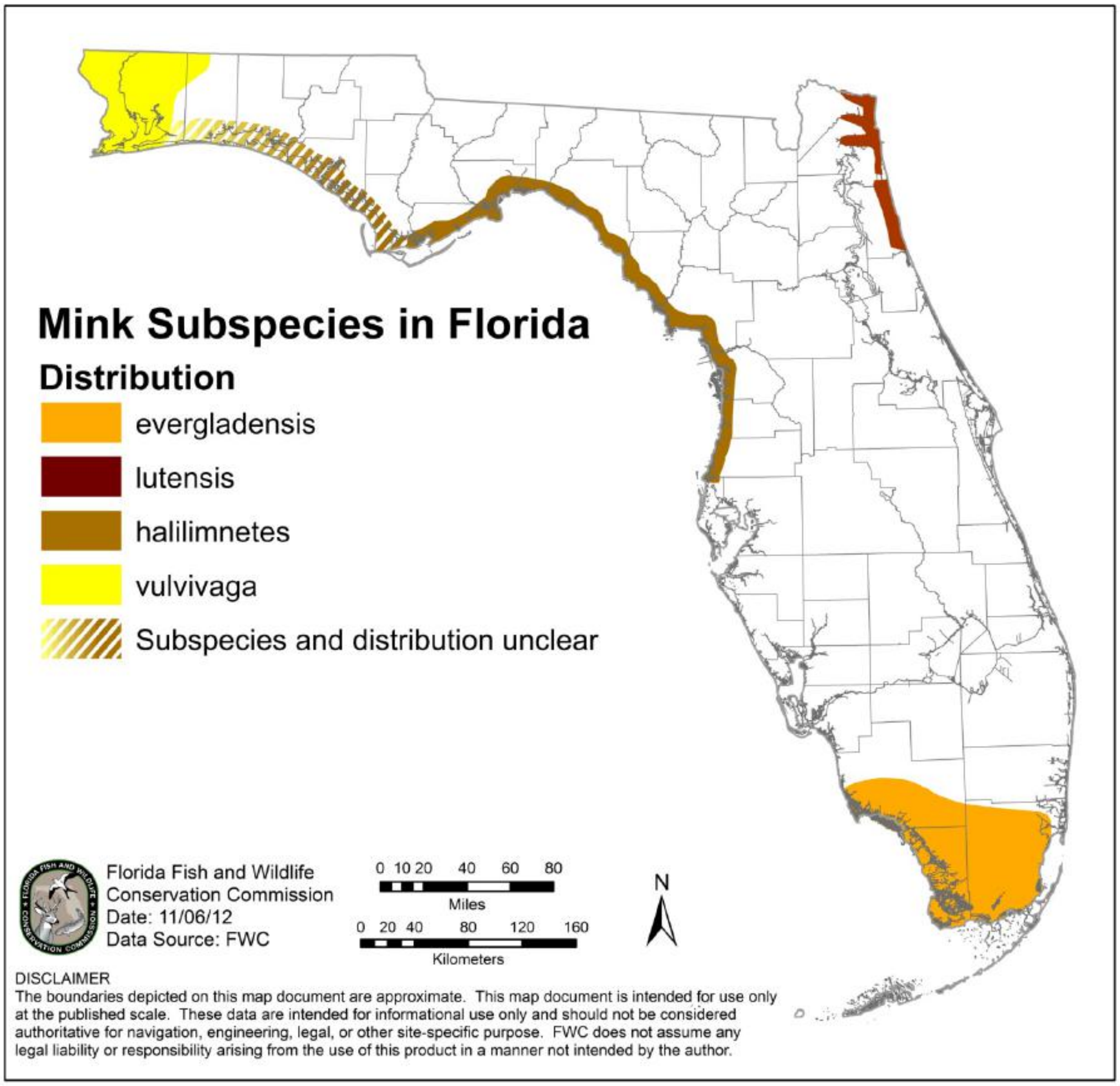


Figure 1-4. Geographic distribution of mink subspecies in Florida (source: FWC 2013c).

2 PROPOSED ACTION

Twelve landowners in Collier County, Florida, (East Collier Property Owners [ECPO], or the Applicants) have applied to the Service for 50-year ITPs (see application numbers listed in section 1) covering activities described in the Eastern Collier Multiple Species HCP (ECPO 2019; hereafter cited in this document as the "HCP"). The proposed Federal action addressed in this BO/CO is the Service's issuance of ITPs in response to these applications in accordance with 50 CFR 17.22 and 17.32 (the Action). The Applicants request incidental take authorization for he 19 species of wildlife identified in Table 1-1. As we noted in section 1.1, we add a twentieth species, the red knot, to the Covered Species for purposes of this BO/CO only. Otherwise, our description of the Action throughout section 2 of this BO/CO is based on the HCP.

The HCP proposes a program that addresses both development and conservation in a large portion (159,489 acres) of Collier County (the Plan Area). The Applicants propose an acreage cap (39,973 acres) on the extent of development (development cap) within designated areas and an assured reservation of natural areas and agricultural lands in which further development is precluded by permanent easements. These easements, executed as lands are developed, would cover about 56% of the Plan Area upon reaching the development cap. This collaboration among 12 landowners seeks to integrate ESA regulatory requirements with the County's Rural Lands Stewardship Area (RLSA) program, under which landowners exchange conservation debits and credits for actions on particular properties. Presently, ESA section 7 consultations with the U.S. Army Corps of Engineers (Corps) on wetlands permits associated with individual development projects provide the mechanism for ESA compliance, and often provide us with an opportunity to request minimization and compensation. Landowners can choose not to participate in the RLSA because it is a voluntary program. If landowners choose not to participate, much of the Preserve Area could be developed, to some degree. The programmatic approach of the HCP establishes a framework via ESA section 10 for development and preservation at the scale of the Plan Area, instead of project-by-project.

The HCP describes residential and commercial development (section 2.3 of the HCP), earth mining (section 2.3 of the HCP), oil and gas exploration (section 2.2 of the HCP), ongoing agricultural land uses (section 2.2 of the HCP), land management (sections 2.2 and 2.3 of the HCP), very low density development (section 2.2 of the HCP), wildlife habitat preservation and enhancement (section 2.2 of the HCP), and existing recreational land uses (section 2.2 of the HCP) (collectively, the "Covered Activities") on 139,442 acres of northeastern Collier County owned by the Applicants. The larger Plan Area for the HCP includes also an additional 20,047 acres of lands "Eligible for Inclusion" in the HCP, which the Applicants do not own. The provisions of the HCP would apply to Eligible lands only when owners of such lands elect to participate in the HCP and receive ITPs. The HCP does not specify the timing, location, and other details of particular developments or projects. Instead, the Applicants propose to carry out the Covered Activities within identified portions of the Plan Area over the requested 50-year permit period according to applicable provisions of the HCP (*i.e.,* Best Management Practices [BMPs], species-specific conservation measures, conservation easements, *etc.*).

This BO/CO predicts the reasonably certain consequences to Covered Species caused by the Action, including the consequences of other activities caused by the Action (effects of the action), and the reasonably certain consequences caused by future non-Federal activities in the Action Area (cumulative effects). Following an identification and description of the Action Area in section 2.1, we organize our description of the Action and our analysis of effects to the Covered Species according to the broad classes of land use designation under the HCP:

- Development and Mining (section 2.2);
- Preservation (section 2.3);
- Base Zoning (section 2.4);
- Very Low Density Development (section 2.5); and
- Eligible for Inclusion (section 2.6).

The HCP's description of land use that may occur in the Base Zoning Area includes contingencies for low- or high-density development, preservation, or some combination thereof.

For reasons we explain in section 2.4, our effects analyses in sections 4 through 20 of this BO/CO include the Base Zoning Area among the lands designated for up to 39,973 acres of residential and commercial/ development under the Development and Mining designated use. In a similar manner, we include the 20,047 acres of the lands Eligible for Inclusion as potentially contributing to the development cap (see section 2.6). In section 2.8, we consider whether other activities would not occur but for the proposed Federal Action, and if so, identify them for analysis in this BO/CO.

Throughout this BO/CO, we cite and summarize aspects of the Applicants' HCP document that are relevant to formulating the Service's BO/CO for the Action. If necessary for clarity in this document, we repeat data reported in the HCP. We evaluate only the Applicants' preferred alternative among the five described in the HCP, which is the proposal the Service is considering for permits issuance. Please refer to the HCP for additional details about the East Collier proposal.

2.1.1 Action Area

The regulations at 50 CFR §402.02 define "action," "action area," and "*effects of the action*" as follows:

"*Action* means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies in the United States or upon the high seas. Examples include, but are not limited to:

(a) actions intended to conserve listed species or their habitat;
(b) the promulgation of regulations;
(c) the granting of licenses, contracts, leases, easements, rights-of-way, permits, or grants-in-aid; or
(d) actions directly or indirectly causing modifications to the land, water, or air."

"*Action area* means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action."

Defining the action area is necessary to determine whether listed species or designated critical habitats may occur in that area, which necessarily precedes any subsequent analyses of the effects of the action to particular species or critical habitats. It is practical and consistent with the regulatory language cited above to treat the action area for a proposed federal action as the spatial extent of its direct and indirect modifications to the land, water, or air. Under the regulatory definition of "effects of the action," such changes include those caused by activities that would not occur but for the action under consultation.

The action area establishes the bounds for an analysis of a species' <u>exposure</u> to action-caused changes, but the subsequent consequences of such exposure are not limited to the action area. For example, habitat modifications may reduce food resources (an action-caused change to land), which causes reduced fitness of individuals wintering in the action area, which then causes reduced reproductive success in a nesting area far removed from the action area. When each link in a predicted causal chain between a change in the action area (that would not occur but for the action) and a predicted consequence of that change is reasonably certain to occur, we determine that the action would cause the consequence. Similarly, habitat modifications may displace individuals from an action area into other areas where essential feeding, breeding, and sheltering behaviors are impaired. We rely upon best available data to identify any consequences of an action to listed species that are reasonably certain to occur later in time outside of the action area, but such effects do not alter the bounds of the action area. The action area does not expand to include a distant breeding area or an area receiving displaced animals. Finally, the action area establishes the bounds for an analysis of cumulative effects, *i.e.,* consequences caused by future non-federal actions that are reasonably certain to occur in the action area.

"*Effects of the action* are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action. (See § 402.17)."

The regulations at 50 CFR §402.17 define "activities that are reasonably certain to occur" and "consequences caused by the proposed action" as follows:

"Activities that are reasonably certain to occur. A conclusion of reasonably certain to occur must be based on clear and substantial information, using the best scientific and commercial data available. Factors to consider when evaluating whether activities caused by the proposed action (but not part of the proposed action) or activities reviewed under cumulative effects are reasonably certain to occur include, but are not limited to:
(1) Past experiences with activities that have resulted from actions that are similar in scope, nature, and magnitude to the proposed action;
(2) Existing plans for the activity; and
(3) Any remaining economic, administrative, and legal requirements necessary for the activity to go forward."

"*Consequences caused by the proposed action*. To be considered an effect of a proposed action, a consequence must be caused by the proposed action (*i.e.,* the consequence would not occur but for the proposed action and is reasonably certain to occur). A conclusion of reasonably certain to occur must be based on clear and substantial information, using the best scientific and commercial data available. Considerations for determining that a consequence to the species or critical habitat is not caused by the proposed action include, but are not limited to:
(1) The consequence is so remote in time from the action under consultation that it is not reasonably certain to occur; or
(2) The consequence is so geographically remote from the immediate area involved in the action that it is not reasonably certain to occur; or
(3) The consequence is only reached through a lengthy causal chain that involves so many steps as to make the consequence not reasonably certain to occur."

2.1.1.1 Immediate Area Involved in the Action

The immediate area involved in this Action is the 159,489-acre Plan Area located in the northeast corner of Collier County, Florida (Figure 2-1). The Plan Area is comprised of 139,442 acres owned by the ECPO Applicants, and another 20,047 acres owned by others that the Applicants designate in the HCP as lands Eligible for Inclusion. The Covered Activities of the HCP would affect the Plan Area by:

- converting existing land cover to residential, commercial, and earth mining uses on up to 39,973 acres in the areas designated as Development and Mining (and possibly in the Base Zoning and Eligible for Inclusion areas);
- converting existing land cover to accommodate low-density occupancy (1 unit per 50 acres) in the Very Low Density use areas;
- converting existing land cover to accommodate residential development at a density of 1 unit per 5 acres in the Base Zoning area; and
- implementing various conservation practices while continuing existing land uses on the designated Preservation areas and on the remaining undeveloped acreage of the Development, Very Low Density, and Base Zoning areas.

The Eligible lands are not included in these proposals at this time; however, the Applicants describe in section 2.4 of the HCP how owners of these lands may elect to participate in the plan. We describe in section 2.6 how the enrollment of Eligible lands could contribute to the 39,973-acre development cap or supplement the designated Preservation lands. Although some or all of the Eligible lands may or may not participate in the HCP, we include these lands in the Plan Area as parts of the immediate area involved in this Action.

The Plan Area lies entirely within the boundaries of Collier County's "Rural Land Stewardship Area" (RLSA), which is comprised of about 195,000 acres surrounding, but not including, the unincorporated Town of Immokalee. The Plan Area covers more than three quarters of the RLSA. As depicted in Figure 2-1, portions of the RLSA that are *not* included in the Plan Area are either:

(a) presently designated/managed for conservation purposes;
(b) addressed in prior Federal permits (three tracts); or
(c) County and State roads.

The three tracts addressed in prior Federal permits ("b" in the list above) are the Hogan Island Quarry, Immokalee Sand Mine, and Town of Ave Maria. These lands are under the Applicants' ownership, but are not included in the Plan Area. The ESA §7 consultation associated with Federal permits for these mining and development actions are concluded. The wetland mitigation associated with these projects was removed from the HCP Preservation lands.

The Applicants adopted a 45,000-acre development cap during the development of the HCP that included the 5,027-acre Town of Ave Maria, which is located south of Immokalee near the center of the RLSA. Because permitting for Ave Maria was completed before the HCP, it is now removed from the Plan Area of the HCP that we consider in this BO/CO. The removal of Ave Maria:

- reduces the development cap of 45,000 acres by 5,027 acres to 39,973 acres; and
- reduces the extent of HCP Preservation lands that would receive conservation easements by 6,779 acres, because these commitments are already completed.

Nothing proposed in the HCP controls future actions within Ave Maria; therefore, Ave Maria is outside the immediate area involved in the Action. Our use of the term “Plan Area” in this BO/CO refers collectively to the 159,489.0 acres comprised of the following HCP land designations:

- Development and Mining (43,767.2 acres);
- Preservation (90,576.3 acres);
- Very Low Density (2,667.4 acres);
- Base Zoning (2,431.1 acres); and
- Eligible for Inclusion (20,0470. acres).

These acreages are presented here and in Tables 2.1 and 2.2 to the first decimal place to demonstrate that they add up to 159,489.0 acres. From this point forward, the acreages in the text will be presented as whole numbers.

The Plan Area is adjacent to several large tracts of public lands that are managed for conservation purposes. Figure 2-2 shows these tracts, which include the Corkscrew Regional Ecosystem Watershed to the west, Okaloachoochee Slough State Forest to the north, and Big Cypress National Preserve and Florida Panther National Wildlife Refuge to the south.

2.1.1.2 Other Areas Affected by the Action

Whether the action area for a consultation extends beyond the immediate area involved in the action depends on the nature and context of changes to land, water, and air caused by the action, including those caused by other actions that would not occur but for the action under consultation. When we can meaningfully predict changes beyond the immediate area involved in the action, we expand the action area accordingly.

Changes that may reach beyond the Plan Area include:

(a) noise, odors, and runoff emanating from construction and mining sites;
(b) smoke from burning piles of cleared vegetation and prescribed fires;
(c) altered surface- and ground-water flows and levels; and
(d) altered patterns or volume of human activity (*e.g.*, vehicular traffic to/from the action footprint).

We do not expect noise and odors from construction and mining activity (“a” above) to extend more than 300 meters from a project site, which would extend beyond the Plan Area only when a project is located along the Plan Area perimeter. These changes are temporary, and limited in scope to the location of particular projects. The HCP does not specify the location or timing of projects; therefore, we cannot reasonably extend the action area to account for noise and odors. We do not expect significant amounts of construction runoff outside the Plan Area, because a purpose of project-level permitting under other Federal, State, and local authorities is to ensure that such runoff is captured onsite.

Similarly, smoke from burning cleared vegetation and prescribed fires (“b” above) is temporary and limited in scope to the location of particular construction projects or burn areas. The HCP does not specify the location or timing of construction projects or prescribed fires; therefore, we cannot reasonably extend the action area to account for smoke. A purpose of permits under State and local authorities for burning cleared vegetation or conducting prescribed fires is to ensure that the risk of severe off-site modifications to land and air is limited to safe levels.

Plan Area development may alter surface- and ground-water flows and levels ("c" above) by increasing the extent of impervious surfaces. However, we have no information about the extent or location of new impervious surfaces that may occur on 39,973 acres within a 66,245-acre potential development envelope. We are unable to predict with reasonable certainty specific hydrologic modifications that would extend beyond the Plan Area resulting from this land modification within the Plan Area.

An increase in vehicular traffic on roads that connect with the Plan Area ("d" above), which would follow new residential and commercial development on 39,973 acres, is a physical change that would extend beyond the bounds of the Plan Area. Traffic volume is a measurable, predictable, and long-term change causally linked to the construction of homes and businesses that serve as the origins or destinations of vehicle trips. Traffic is relevant to several of the Covered Species, especially the Florida panther, for which collisions with vehicles is a substantial cause of annual mortality. In section 3 of this BO/CO, we explain the methods and report the results of our analyses for estimating the volume of traffic on the existing road network that would not occur but for the developments within the HCP and is reasonably certain to occur. Based on these analyses, we include in the Action Area of this BO/CO various road segments that cross the Plan Area and extend beyond the Plan Area. On these road segments we estimate also the volume of traffic from other sources for our analyses of cumulative effects. Thus, the Action Area for this analysis consists of the Plan Area (159,489 acres) plus 5,072 discrete road segments totaling 1,825 miles (Figure 2-2). The Appendix B lists all of the road segments included in the Action Area.

2.1.1.3 Habitat Types

In this section, we report the acreage of habitat types in the Plan Area. These data come from an overlay of the land use designations of the HCP (a geographic data file we obtained from the Applicants) and the Cooperative Land Cover (CLC) classes of the Florida Fish and Wildlife Conservation Commission (FWC) and Florida Natural Areas Inventory (FNAI) (2016). This overlay provides the spatial extent of habitat changes to which the Covered Species may be exposed for our analyses in sections 4–20 of the BO/CO. Chapter 3 of the HCP provides additional information about environmental conditions in the Plan Area, which we cite as necessary throughout this BO/CO.

Table 2-1 lists the land cover types and corresponding acreage within the Plan Area. We organize the CLC classes by general categories (*e.g.*, Active Agriculture, Native Wetland), and within each category, sort the CLC classes in descending order of total acreage. Columns of the table provide an acreage breakdown within the five land-use designations of the HCP:

- Development and Mining (see section 2.2);
- Preservation (see section 2.3);
- Base Zoning (see section 2.4)

- Very Low Density(see section 2.5); and
- Eligible for Inclusion (land-use designation subject to “certificates of inclusion;” see section 2.1.1).

Table 2-2 consolidates the CLC data in Table 2-1 by general land use/land cover categories: active agriculture, native wetland, native upland, existing development, and other types. Active agriculture is the largest category, covering almost half (48.3%) of the Plan Area, followed by native wetlands (36.7%), and native uplands (8.3%). The “Other” land use category in Table 2-2 consists mostly of open rural lands that are not in active agricultural use.

2.1.1.4 Methods for Estimating the Extent of Development by Habitat Types

Our predictions of the effects of HCP development activity on Covered Species must deal with the uncertainties that arise from the Applicants’ HCP development on up to 39,973 acres (the development cap) within a 66,245-acre portion (development envelope) of the Plan Area. The full extent of the potential development envelope is comprised of three land-use designations of the HCP:

- Development and Mining (43,767 acres);
- Base Zoning (2,431 acres); and
- Lands Eligible for Inclusion (20,047 acres).

In this section, we explain two methods (“Proportional” and “Reasonable Maximum Impact”) that we use for making inferences about which 60.3% of the development envelope (39,973 of the 66,245 acres) we attribute to development in our species-specific effects analyses. The analysis for each species uses only one of the two methods.

For both methods, we first reduce the size of the potential development envelope by removing the areas of existing development and open water from further consideration, because these cover classes are highly unlikely to host new development subject to the HCP development cap. Table 2-3 reports the acreages for the three development land-use designations in the columns labeled A, B, and C, with the acreages for existing development and open water segregated to the bottom of the table with a corresponding subtotal. The cover classes listed above the first subtotal represent the remaining portion of the development envelope for our analyses of development effects. Removing existing development and open water classes reduces size of the potential new development envelope from 66,245 to 64,757 acres. The development cap of 39,973 acres is 61.7% of this smaller envelope, instead of 60.3% of the larger envelope. Following this reduction of the development envelope, our two analysis methods diverge, as explained below.

<u>**Proportional Method**</u>

Our “Proportional” method for estimating the extent of each cover class that new development could affect is a proration of the acreages reported in columns A–C of Table 2-3. Because the development cap is 61.7% of the potential development envelope, we expect that 61.7% of each cover class will support development. We cannot identify the properties that will comprise this 61.7%; therefore, our analyses using the Proportional method cannot make firm predictions of effects based on available site-specific species data. This method merely estimates the acreage of development within particular cover classes.

We can identify plans for the Rural Lands West (RLW) development as the type of project that would fill the HCP development cap. The owners of the RLW properties submitted development plans to the Corps for necessary Federal permits (Passarella & Associates, Inc. 2017). Although the owners subsequently withdrew these plans, we consider the proposals mature enough to warrant identification in our analyses as areas that are more likely than not to satisfy part of the HCP development cap. The relative abundance of cover classes in RLW is different from that of the development envelope as a whole. For example, Orchards/Groves cover 40.5% of the development envelope (excluding existing developed areas and open water), but none are present in RLW. Because we know that the foreseeable development of RLW does not include any Orchards/Groves, we can expect development of less than 61.7% of all Orchards/Groves in the full development envelope. Similarly, we should expect development of more than 61.7% of cover classes that are relatively more abundant in RLW. We adjust our proration of cover class acreages in the full development envelope using the likely disposition of the RLW area as follows:

- Column D of Table 2-3 lists the acreages of cover classes within RLW. Proposed development in RLW (excluding 61 acres of existing development and 2 acres of open water) will account for 4,011 acres (column D, first subtotal) of the development cap.
- Column E sums the acreages for the full development envelope (columns A, B, and C) and subtracts the RLW acreage from this total.
- Column F computes the prorated acreage for development within the column E total.
- Column G returns the RLW acreage to the column F total. Column G is the acreage of each cover class that we attribute to development under the Proportional method. Note that the total acreage for all cover classes in column G is the development cap of 39,973 acres.
- Column H represents the undeveloped acreage following full development of 39,973 acres for each cover class that we expect under the Proportional method. Permittees (ECPO and the owners of any eligible lands enrolled in the HCP) would secure these undeveloped lands with conservation easements.

We use the Proportional method when:

(a) the species may occur on many cover classes, and the relative importance of most of these is not sufficiently different to warrant the Reasonable Maximum Impact method (described in the following subsection); or
(b) the species is associated primarily with native wetland cover classes.

The additional difficulties and permitting requirements associated with development in native wetlands, which cover 8,115 acres (12.5%) of the 64,757-acre development envelope, makes them less likely to host development than other cover classes. It is possible, but highly unlikely, for the development cap to avoid entirely native wetlands within the development envelope. Native wetlands within the proposed RLW development and the permitted Ave Maria development cover 5.0 and 2.6%, respectively, of these areas, compared to the 12.5% wetlands coverage in the full development envelope of the HCP. This suggests some degree of, but not complete, wetlands avoidance in these developments. Rather than choose an arbitrary development percentage for wetlands less than 61.7%, we apply the Proportional method in the same manner to all cover classes, and consider it a modest overestimate of impacts to wetlands and species associated with wetlands, but not a maximum impact scenario.

<u>Reasonable Maximum Impact Method</u>

We use the Reasonable Maximum Impact (RMI) method for species associated with cover classes that could receive a disproportionate share of the development cap in the development envelope (*i.e*., more than 61.7%). As discussed in the previous subsection, we do not use this method for species associated primarily with native wetlands, because wetlands are highly unlikely to receive a disproportionate share of the development cap. Under the RMI method, we rank the cover classes that the species uses as habitat in order of importance and attribute development to the full acreage of each class in rank order up to the 39,973-acre development cap. If the resulting attribution of development to cover classes is feasible under the HCP and not otherwise unreasonable, the RMI method represents a plausible development scenario that would have the greatest impact on the species.

When justified, an analytical advantage of the RMI method is that the spatial distribution of development on cover classes that the species uses, and which collectively have a lesser abundance than the development cap, becomes spatially explicit. Under the Proportional method, the location of the approximately 61.7% of each cover class in the development envelope that will support development is not determinable.

Under the RMI method, the likely disposition of lands within RLW, which affected the proration of cover classes under the Proportional method, is not relevant. We attribute all the acreage of a particular cover class in the development envelope with which a species is associated to development, including any acreage within RLW. Table 2-4 is an example of the RMI method for a hypothetical species that is associated with a mix of agricultural and native upland cover classes.

2.1.2 Development and Mining

The HCP designates 43,767 acres of the Plan Area as the primary area (along with lands Eligible for Inclusion and possibly Base Zoning) for up to 39,973 acres of residential/commercial development and mining (labeled as the "Covered Activities" in the HCP) (see Figure 2-1). The Applicants propose to continue their current land uses (agriculture, silviculture, recreation, exotic and nuisance species control, oil and gas exploration/production) in the Development Areas until they convert tracts for commercial/residential uses or earth mining. After reaching the 39,973-acre development cap on HCP-enrolled lands in the Plan Area, permittees would add any remaining undeveloped portions of the Development Areas (at least 3,794 acres; more if Eligible lands are enrolled and developed) to the Preservation Areas (see section 2.3).

As we discussed in section 2.1.1, the ECPO Permittees may agree with owners of lands "Eligible for Inclusion" in the HCP to substitute such lands for those designated for Development and Mining in the HCP. Such inclusion would not alter the development cap that applies to the HCP and any ITPs issued.

2.1.2.1 Sub-Activities and Stressors

Appendix A of the HCP contains the Applicants' deconstruction (parsing of major components into constituent parts) of the HCP development and mining activity. The deconstruction identifies stressors (changes to the environment) associated with various sub-activities, and notes the spatial and temporal distribution (radius and duration/frequency) for the Covered Species' potential exposure to each stressor.

Commercial/residential development is divided into three phases: (1) pre-construction; (2) horizontal construction; and (3) vertical construction. Earth mining is divided into four phases: (1) pre-construction; (2) mining; (3) conversion to development; and (4) reclamation activities. Each of these phases is comprised of various activities (*e.g.*, surveys, vegetation clearing, building construction) and sub-activities (*e.g.*, vegetation piling/burning, road bed grading). Each sub-activity would introduce one or more stressors to which the Covered Species may respond, if exposed.

The Applicants deconstruct the HCP development and mining into 49 and 44 unique sub-activities, respectively, which we list in Tables 2-5 and 2-6. Stressors identified for 91 of these 93 sub-activities are noise and human disturbance. Habitat loss is a general stressor identified for the vegetation clearing activity during the pre-construction phase of both development and mining. Vegetation clearing is parsed further into sub-activities according to the type of habitat cleared (*e.g.*, citrus orchard, pasture, native forest). Other stressors identified include the introduction of smoke from burning piles of vegetation debris and fuel/oil/odor from equipment use.

2.1.3 Preservation Activities

The HCP designates 90,576 acres of the Plan Area for eventual preservation under permanent conservation easements (collectively, the Preservation Area) (see Table 2-2). Permittees would execute conservation easements under the County's Rural Lands Stewardship Program's crediting system as they convert portions of the Development Area (along with enrolled lands Eligible for Inclusion and possibly Base Zoning) to commercial/residential or mining, and possibly enhance over time the value of the land as wildlife habitat and a corridor for regional wildlife movement. Fees collected from the development activity would fund habitat maintenance and enhancement activities (see section 2.7). The easements would preclude future commercial/residential development and earth mining, but would allow a continuation of the existing agricultural land uses.

Until landowner Permittees execute easements on properties within the Preservation Area, the HCP prescribes a continuation of existing land uses, which include:

- crop cultivation;
- ranching/livestock operations;
- forestry and silviculture;
- recreation;
- exotic and nuisance species control; and

- oil and gas exploration and production.

Permittees under the HCP would annually document the proportion of landcover in the Preservation areas that consists of native habitats and the proportion used for agricultural purposes. The HCP seeks to maintain 100% of the current extent of native habitats and agricultural uses in the Preservation areas, but stipulates a 95% standard to "allow a degree of flexibility in accomplishing restoration of land cover as needed" (HCP section 2.2).

Upon reaching the 39,973-acre development cap on enrolled lands in the Plan Area, permittees would place remaining undeveloped portions of the Development Areas under conservation easements. At that time, the total area under such easements would then encompass 90,576 plus at least 3,794 acres (the total acreage of the Development areas minus the cap), depending on whether some Eligible lands and/or Base Zoning lands substitute for designated Development areas. The final ratio of Preservation to Development acreage in the Plan Area would equal or exceed (90,576 + 3,794) ÷ 39,973 = 2.36.

In addition to authorization for take of the Covered Species in the Development areas, the Applicants also seek authorization for take that is incidental to land management activities within the Preservation and Very Low Density Use areas. These activities include:

- prescribed burning;
- mechanical control of groundcover (*e.g.*, roller chopping, brush-hogging, mowing);
- ditch and canal maintenance;
- mechanical and/or chemical control of exotic vegetation;
- soil tillage; and
- similar activities that maintain or improve land quality.

2.1.4 Base Zoning

The HCP designates a single property, the Half Circle L Ranch, as "Base Zoning." This 2,431-acre ranch (1.5% of the Plan Area) is located on the northeast edge of the Plan Area (see Figure 2-1). Base Zoning means that development at a density of up to 1 dwelling unit per 5 acres, and/or ongoing agricultural uses, may occur consistent with current land use zoning for the RLSA. The Applicants would account for any development of the Base Zoning Area, including possible development at densities greater than 1 unit per 5 acres, in the 39,973-acre effective development cap for the Plan Area. Higher-density development in the Base Zoning Area would displace an equivalent acreage from the areas designated for Development, and place an acreage into the areas designated for Preservation according to provisions of the RLSA, as adopted in the HCP. Until the owner of the Half Circle L Ranch decides whether to develop some or all of the property, it is *not* included in the HCP acreage for the Development, Preservation, or Very Low Density Use areas.

At this time, the owner of the Half Circle L Ranch has placed it for sale on the open market. The current or the future owner may choose to participate in or withdraw from the HCP, and may choose to develop the property or to continue current agricultural practices. Regardless whether its owner develops the Base Zoning Area under the HCP or withdraws it from the HCP altogether, the development cap for the HCP is 39,973 acres.

We cannot consider the Base Zoning Area among the lands designated for Preservation, because it is not. We cannot consider that it is limited to a development density of 1 unit per 5 acres, because the HCP allows Base Zoning lands to substitute for Development lands that do not have this restriction. Therefore, we conservatively treat the Base Zoning Area in this BO/CO as contributing up to 2,431 acres to the development cap, the same as other lands within the Development Area.

Treating the Base Zoning Area as available for high-density development is consistent with purpose of this BO/CO, which is to determine whether the Action is likely to jeopardize the continued existence of any of the Covered Species. If the Action satisfies this permit issuance criterion under this scenario, it will do so whether the Half Circle L Ranch is preserved or developed at lower densities than the Development areas. Therefore, our effects analyses in sections 4 through 20 of this BO/CO include the Base Zoning Area among the lands designated for up to 39,973 acres of commercial/residential development.

2.1.5 Very Low Density Development

The Applicants designate three areas, located on the southern and eastern edges of the Plan Area, for "Very Low Density" (VLD) uses (see Figure 2-1). These parcels have a combined acreage of 2,667 acres (1.7% of the Plan Area). VLD uses include isolated residences, lodges, and hunting/fishing camps, as well as a continuation of existing agricultural (primarily cattle grazing) and silvicultural activities. The HCP limits dwellings in the VLD areas to no more than one unit per 50 acres, and limits vegetation clearing to no more than 10% of the existing native vegetation (HCP chapter 2.2).

About 668 acres (25.0%) of the VLD areas are open water (see Table 2-2). Native vegetation types cover 1,180 acres (44.2%), of which 447 acres are upland types and 733 acres are wetland types. Within the native cover types, Covered Activities include, but are not limited to:

- exotic and nuisance species control;
- prescribed burning;
- mechanical control of excessive forest understory/fuel loads;
- tree thinning to improve native forest productivity;
- mechanical, hydrologic, and/or chemical control of vegetation to improve community structure and/or plant species diversity;
- construction and maintenance of surface water management structures for preservation or enhancement of existing/natural hydrologic function; and
- scouting and monitoring of lands on foot, horseback, or by vehicle (HCP Chapter 2.2).

The HCP does not specify where clearing up to 10% of the native vegetation types would occur. Clearing 10% of the native vegetation would reduce their total extent by 118 acres. The maximum density of 1 unit per 50 acres over the full extent of the VLD areas (2,667 acres) for the construction of residences, lodges, and hunting/fishing camps corresponds to 2,667 ÷ 50 = 53 units. If located entirely within 118 acres of cleared native cover types, 53 units would occupy an average of 2.2 acres each.

The construction of up to 53 dwelling units within the VLD areas could occur mostly or entirely on land cover types besides native uplands and wetlands (*e.g.,* on 502 acres of improved pasture or on 241 acres of rural open lands). However, we must evaluate the HCP as proposed, which stipulates clearing of up to 10% of the native vegetation within the VLD areas. Consistent with our proportional method for distributing the development cap among cover types (see section 2.1.4), we allocate the effects of land clearing among all cover types represented in the VLD areas. Table 2-7 provides calculations for the maximum extent of potential clearing (10% removal of each native cover type), which we represent as a conversion of 118 acres of the native cover types to the land cover class "Rural Structures."

2.1.6 Eligible for Inclusion

The Applicants identify 20,047 acres in the Plan Area that they do not own as lands "Eligible for Inclusion" in the HCP (see Figure 2-1, and Tables 2-1 and 2-2). Owners of properties within the lands "Eligible for Inclusion" could elect to participate in the HCP during its implementation. Such enrollment could not increase the total amount or extent of incidental take authorized under ITPs issued to the ECPO Applicants for the HCP, and all relevant conservation commitments of the HCP would apply to any new lands covered. We explain in section 2.1.1 how the possibility of substituting Eligible lands for those assigned to the Development and Mining uses, or adding to those assigned to the Preservation uses, expands the immediate area involved in the Action. In section 2.1.4, we explain our methods for including the Eligible lands in the scope of our species-specific effects analyses.

The ECPO Applicants do not describe a specific process for admitting eligible lands to the HCP. Whatever process they may adopt, at the time of a new enrollment, the ECPO permit holders would need to demonstrate that the amount or extent of take authorized for the HCP has not been exceeded (*i.e*., actions in the HCP that the Service expected to cause the authorized take have not yet occurred). Satisfying this condition would allow the permit holders to share with an owner of eligible lands the authorization for take that has not yet occurred. The enrollee would need to apply for, and the Service would need to issue, a separate ITP for the eligible lands. The ITP would replicate all previous requirements for take authorization associated with the HCP. Similarly, the owners of eligible lands within the Plan Area could sell lands to an ECPO or other enrolled permittee. That permittee could conduct Covered Activities on a newly-acquired property in accordance with their existing, an amended, or a new permit depending on circumstances.

The addition of Eligible lands to the HCP is uncertain. Owners of the Eligible lands are under no obligation to participate in the HCP. All persons under U.S. jurisdiction are subject to the take prohibitions of the ESA, and non-Federal entities may seek authorization for incidental take caused by their actions through an HCP/ITP. If private landowners seek Federal funding or permits for actions that may affect listed species or designated critical habitat, the Federal agency assumes responsibility for ESA compliance, including compliance with the take prohibitions. Owners of Eligible lands that choose to participate in the HCP to obtain take authorization would need to negotiate with the ECPO permittees for any substitution of their lands for ECPO lands assigned to the Development and Mining land use category of the HCP and any associated addition of their lands to those assigned to the Preservation category. Regardless whether

Eligible lands enter the HCP, the development cap of the HCP evaluated in this BO/CO is 39,973 acres.

2.1.7 Other Activities Caused by the Action

A BO/CO evaluates the consequences to species or critical habitat that are caused by the proposed Federal action, including the consequences of other activities that are caused by the proposed action and are reasonably certain to occur (see definition of "effects of the action" at 50 CFR §402.02). Regulations at 50 CFR §402.17(a) specify criteria for identifying such activities:

(a)*Activities that are reasonably certain to occur*. A conclusion of reasonably certain to occur must be based on clear and substantial information, using the best scientific and commercial data available. Factors to consider when evaluating whether activities caused by the proposed action (but not part of the proposed action) or activities reviewed under cumulative effects are reasonably certain to occur include, but are not limited to:

- (1) Past experiences with activities that have resulted from actions that are similar in scope, nature, and magnitude to the proposed action;
- (2) Existing plans for the activity; and
- (3) Any remaining economic, administrative, and legal requirements necessary for the activity to go forward.

The Applicants own the properties included in the Development, Preservation, Base Zoning, and Very Low Density designations of the HCP, but not the Eligible lands. The HCP describes activities for which the Applicants (and owners of Eligible lands that agree to participate in the HCP) seek authorization for incidental taking of listed species, and describes activities intended minimize and mitigate the impacts of such taking. Development on the Eligible lands may occur independent of the HCP, and we are unaware of any third-party development proposals that would not occur but for the activities described in the HCP. Because the Applicants propose the possible addition of Eligible lands to the HCP, we include the Eligible lands in the Action Area. The Applicants propose to use the Marinelli Fund, in part, to finance the construction of wildlife crossings (see HCP section 9.5), which third parties (State and County transportation agencies) would carry out, so this is part of the proposed Action.

Third-party activities that are not a part of, but would be caused by, the development activity of the HCP, are the collective activities of future residents of the new developments. An increase in human habitation within the Plan Area is reasonably certain to occur, because creating the conditions (residences, commercial buildings, infrastructure) for such habitation is the intended outcome of the HCP development activity. Following changes caused by the Covered Activities (clearing, construction, land management, *etc.*), new residents of the Plan Area would cause additional changes. Such changes include, but are not limited to, a long-term increase in: human activity; pet populations; garbage; nighttime lighting; noise; and vehicular traffic on roads through and leading to the Plan Area. Of these changes, increased traffic extends the Action Area the farthest from the Plan Area boundaries, and is relevant to several of the Covered Species. In section 3 we describe the data and methods we have used to estimate the reasonably certain spatial extent and scale of the increase in traffic caused by a larger human population in the Plan Area. When relevant, we consider whether other changes caused by increased human habitation of the Plan Area are sources of reasonably certain consequences to Covered Species in each species-specific effects analysis.

2.1.8 Goals for Species

The HCP Handbook (USFWS and NMFS 2016) addresses how biological goals and objectives are to be established in Habitat Conservation Plans. The biological goals and objectives established in the plan must be consistent with the conservation and recovery goals established by the Service for the species. The goals are intended to provide an understanding of why specific conservation measures are necessary. These goals are developed based on the species' biology, threats to the species, the potential effects of the Covered Activities, and the conservation scope of the plan.

Because of the landscape scale of the HCP and the large areas of habitat used by panthers, the HCP incorporates specific biological goals for panthers. It also includes biological goals for the other Covered Species. The biological goals for panthers, as described in Section 4.3 of the HCP, are the following:

1. Preserve and maintain large, interconnected blocks of Florida panther habitat (approximately 100,000 acres as calculated by GIS)
2. Enhance Florida panther habitat and facilitate panther movement across the landscape
3. Provide funding to the Marinelli Fund that can be used to enhance, restore, and/or establish panther habitat to facilitate panther movements across the landscape within the HCP Area. While impacts to panther habitat (predominantly previously-cleared areas) are fully offset through the preservation and maintenance of approximately 100,000 acres of land by the permittees, this funding is expected to provide additional conservation benefits through the enhancement of an existing corridor that has been historically traversed by panthers crossing SR-29, and the establishment of a corridor to facilitate dispersal of panthers northward from the Corkscrew Marsh area.

The general biological goals for the other Covered Species, as described in Section 7.1 of the HCP, are the following:

1. Preserving and maintaining a landscape mosaic of native habitats, pastures, and rural open space within the lands designated under the Plan for Preservation/Plan-Wide Activities and Low Density Use that provides major conservation benefits to the Covered Species, including the regional wildlife corridors that provide landscape-scale linkages between existing public conservation lands;
2. Providing in-kind mitigation for permanent losses of other Covered Species habitat associated with implementation of the Covered Activities, including habitat preservation, and habitat restoration, enhancement, and/or creation; and
3. Contributing to the Marinelli Fund, which will be used to fund initiatives and activities that provide conservation benefits to the Florida panther and the other Covered Species.

For the objectives and measures related to panther biological goals, refer to Section 4.3.1 in the HCP. For the objectives and measures related to other species biological goals, refer to Section 7.2 in the HCP.

2.1.9 The Marinelli Fund and Proposed Conservation Measures

Marinelli Fund

ECPO collaborated with several environmental groups to develop the Florida Panther Protection Program (FPPP), which seeks to assist panther recovery. To finance panther protection and habitat enhancement activities, the FPPP established the Marinelli Fund. While the Marinelli Fund would assure HCP implementation monitoring and reporting costs during implementation (HCP section 9.4), its major purpose is to assist with panther conservation and recovery activities throughout the Plan Area (HCP section 9.5).

The Marinelli Fund will receive contributions on a per-acre basis as Permittees initiate development projects within the Plan Area under the HCP, and will receive transfer fees thereafter on a per-unit basis as homes are sold and re-sold.

The activities financed by the Marinelli Fund may include (from Section 9.5 of the HCP for the full range):

- design and construction of wildlife underpasses and fencing along roadways to prevent wildlife/vehicle collisions;
- panther habitat acquisition, management, restoration and/or enhancement; and
- other activities that are consistent with the goals of the FPPP or that benefit other Covered Species of the HCP.

The HCP proposes to dedicate the first $12.5 million of the Marinelli Fund to wildlife roadway crossings that specifically target benefits to the Florida panther (HCP section 9.5). Over the requested 50-year permit term, the Applicants anticipate the Fund would generate $150 million (HCP section 9.2). Chapter nine of the HCP more fully explains the governance, funding, purposes, principles, and priorities of the Marinelli Fund.

Conservation Measures

The HCP's primary measure to avoid and minimize impacts to the Florida panther and other Covered Species is the designation of contiguous lands for Preservation and Very Low Density (VLD) uses. The goal of these designations is to maintain or enhance over time the proportions and quality of native habitats in these areas, while continuing existing agricultural land uses. The Preservation and VLD areas contain the majority (85%) of Plan Area native habitats (see Table 2-2).

The HCP describes conservation measures that apply to particular Covered Species in Section 4 (Florida Panther) and Section 7 (Conservation Plan for Other Covered Species). Such measures include pre-construction surveys, buffer zones around identified burrows/roosts, *etc.* We consider how these measures would influence the consequences to Covered Species resulting from Covered Activities under the HCP in the species-specific effects analysis sections of this BO/CO.

The Applicants have committed (HCP section 7.6.1.2) to the following project-level planning measures and best management practices (BMPs) in order to further enhance the conservation value of the HCP, including the northern and southern wildlife corridors. These measures, described in the bullet points below, will be required for developments under the HCP.

- Prescribed Fire and Smoke Notice. As applicable, final development plans, associated homeowner's documents, and other documentation associated with residential and commercial development projects within the HCP Area will provide notice of the use of prescribed fire in the area, irrespective of the previous or planned use of prescribed fire on the site of the development itself. This notice will be provided and recorded in a manner such that initial and subsequent residents and owners will be made aware of the use of prescribed fire in and around the HCP Area to manage wildland fuels and maintain fire-adapted ecological communities within preserve areas. The following notice concerning the use of prescribed fire will be provided:
    - Periodic prescribed burning is a recognized land management tool and a recommended method of fuel management within and around the HCP Area for minimizing wildfire hazards and maintaining healthy fire-adapted ecological communities. Homeowners acknowledge that they have received notice that prescribed burning may result in the periodic occurrence of temporary smoke and ash that drifts through developed areas.
- Environmental Education and BMPs for Living with Wildlife. The materials contained in Appendix B of the HCP document will be included with the Homeowners' Association (HOA) documents for each residential development community within the HCP Area at the time of HOA incorporation. Decisions regarding which educational materials and BMPs will be implemented within each community are left to the HOA and community residents, but the materials will be transferred to the developer(s) and HOA(s).
- Securing and Vaccinating Pets. HOA and/or homeowners' documents for residential developments within the HCP Area will state that pets within those developments should be kept indoors, on leash when outdoors, or secured within a secure covered kennel. Residents will be informed that vaccinating cats for feline leukemia virus (FLV) can prevent disease transmission from house cats to Florida panthers. As there is no definitive cure for FLV, community-wide vaccination of all pet cats protects homeowners' pets from illness, as well as preventing illness in Florida panthers.
- Development Lighting Adjacent to the Northern and Southern Corridors. Plans for commercial and residential developments within the HCP Area that are submitted to federal and state regulatory agencies will detail the lighting plans and proposed restrictions adjacent to the northern and southern wildlife corridors (Figure 4-9) in terms of (i) distance of fixtures to the corridor edge(s); (ii) fixture types; (iii) degree of fixture shielding (to limit skyglow, light trespass and glare); (iv) light sources, including low-pressure sodium (LPS), high-pressure sodium (HPS), and metal halide and light emitting diodes (LEDs); (v) brightness; (vi) correlated color temperature (in degrees Kelvin); and (vii) use of passive lighting (e.g., roadway reflectors; unlighted road signs). These lighting plan details will form a technical basis for the developer and the Service to perform a HCP/ITP consistency check as to whether the lighting plan adequately minimizes artificial light at the corridor edge(s) and maintains the functionality of the corridor for crepuscular and nocturnal wildlife movement.

- Open Space Buffers. Commercial and residential developments within the HCP Area will comply with Policy 4.13 of the Collier County Future Land Use Element for the RLSP, which states as follows: "Open space within or contiguous to a SRA shall be used to provide a buffer between the SRA and any adjoining FSA, HSA, or existing public or private conservation land delineated on the Overlay Map. Open space contiguous to or within 300 feet of the boundary of a FSA, HSA, or existing public or private conservation land may include: natural preserves, lakes, golf courses provided no fairways or other turf areas are allowed within the first 200 feet, passive recreational areas and parks, required yard and set-back areas, and other natural or manmade open space. Along the west boundary of the FSAs and HSAs that comprise Camp Keais Strand, i.e., the area south of Immokalee Road, this open space buffer shall be 500 feet wide and shall preclude golf course fairways and other turf areas within the first 300 feet." Under the RLSP, development plans must conform to this policy to gain development approvals from Collier County.

The Applicants have stated objectives for (HCP section 7.6.1.3) project-level planning measures and best management practices (BMPs) in order to further enhance the conservation value of the HCPs wildlife corridors. These objectives will be incorporated into developments under the HCP.

- Designing master plans that (i) concentrate more intensive land uses within the center of mixed-use residential/commercial developments (town centers), located at a distance from habitat preservation areas outside the development area, and (ii) diminish land use intensities adjacent to habitat preservation areas (e.g., providing transitions from mixed-use town centers, to residential neighborhoods, to community open space areas, to surface water management (lakes), to project boundaries and project perimeter buffers);
- Minimizing impacts to native habitats within project boundaries that occur along the interface with habitat preservation areas external to the project;
- Utilizing a combination of design elements, including surface water management lakes, berms, structural buffers, fencing, and directional and/or low-level lighting along the periphery of Covered Activities to minimize the effects of light, noise, and human activity on areas outside the project boundaries, and to minimize human interactions with Covered Species;
- Designing internal roadway networks and roadway elements to minimize the potential for wildlife-vehicle collisions within the lands designated for Covered Activities. These elements may include strategic selection of key road segments for wildlife crossing structures such as box culverts, small animal culverts, wildlife pipes, amphibian tunnels; the use of landscaping, curbs, fencing, and other barriers to direct wildlife to safe road crossing areas; wide, open road shoulders near crossings to maximize visibility for wildlife and motorists; and wildlife crossing signage (Kautz et al. 2010);
- Providing a sustainable mix of residential, commercial, retail, office, civic, and recreational land uses where these non-residential components minimize the need for residents to leave the development for basic needs (maintaining a high internal capture rate), thereby minimizing travel on the regional transportation network; and

- In the case of earth mining, establishing perimeter berms to separate the mine areas from adjacent preservation areas (where present adjacent to the mine), and limiting offsite transport of mining products to daylight hours.

2.2 Tables and Figures for Proposed Action

Table 2-1. Land cover class acreage within the Plan Area by designated use under the HCP. Percentages reported are row or column totals divided by the grand total (159,489 acres).

GENERAL CATEGORY	COOPERATIVE LAND COVER CLASS	DEVELOP-MENT	PRESER-VATION	VERY LOW DENSITY	BASE ZONING	ELIGIBLE FOR INCLUSION	ROW TOTAL	ROW PERCENT
Active Agriculture	Orchards/Groves	18,481.80	8,784.00	0	0	7,772.00	35,037.80	22.0%
	Cropland/Pasture	14,548.60	9,158.70	0	698.4	2,496.00	26,901.70	16.9%
	Improved Pasture	4,392.60	7,599.40	501.8	1,082.40	1,546.00	15,122.30	9.5%
	Other Agriculture	0	1.1	0	0	0	1.1	0.0%
Native Wetland	Marshes	1,007.20	14,232.80	123.9	0	1,335.00	16,698.90	10.5%
	Cypress	141.2	11,549.80	17.4	0	1,270.00	12,978.40	8.1%
	Prairies and Bogs	708.4	8,205.10	97.6	0	1,152.00	10,163.10	6.4%
	Freshwater Forested Wetlands	110.1	4,094.30	357.2	0	662	5,223.60	3.3%
	Isolated Freshwater Swamp	168.1	3,681.40	40.4	0	173	4,062.90	2.6%
	Wet Flatwoods	134.8	2,300.20	3.2	53.3	20	2,511.50	1.6%
	Cypress/Tupelo	142.4	1,787.10	69.7	0	262	2,261.20	1.4%
	Isolated Freshwater Marsh	9.4	1,156.10	1.7	536.5	102	1,805.70	1.1%
	Strand Swamp	0	1,742.80	0	1.1	14	1,758.00	1.1%
	Other Hardwood Wetlands	4.3	437	22.1	0	53	516.3	0.3%
	Dome Swamp	0	279.4	0	37.2	0	316.5	0.2%
	Hydric Hammock	0	116.8	0	1.8	0	118.6	0.1%
	Freshwater non-Forested Wetlands	5.7	99.4	0	0	0	105.1	0.1%
	Other Coniferous Wetlands	11	12.8	0	0	0	23.7	0.0%
Native Upland	Mesic Flatwoods	938.4	6,026.00	112.3	0	314	7,390.60	4.6%
	Mixed Hardwood-Coniferous	240.2	2,240.70	135	0	165	2,780.90	1.7%
	Mesic Hammock	417.2	1,129.30	61.4	16.3	167	1,791.20	1.1%
	Shrub and Brushland	206.6	658.9	138	0	88	1,091.50	0.7%
	Palmetto Prairie	1.5	127	0	0	0	128.4	0.1%
	Scrubby Flatwoods	0	29.4	0	0	0	29.4	0.0%
	Scrub	0	9.3	0	0	0	9.3	0.0%
Other	Rural (Rural Open Lands)	1,414.80	4,154.80	240.9	0.3	1,153.00	6,963.80	4.4%
	Exotic Plants	291.7	528	1.9	0	59	880.6	0.6%
	Fallow Orchards	0	39.1	0	0	102	141.1	0.1%
	Extractive	0	8.2	61.2	0	34	103.3	0.1%
	Cultural - Terrestrial	0	7.4	0	0	15	22.4	0.0%
	Bare Soil/Clear Cut	0	7.1	0	0	0	7.1	0.0%
Existing Development	Low Intensity Urban	178.8	51.9	0.4	0	303	534.1	0.3%
	Transportation	105.4	84.2	13.8	3.9	200	407.3	0.3%
	High Intensity Urban	33.2	10.4	0	0	48	91.7	0.1%
	Utilities	0.5	1.7	0	0	0	2.3	0.0%
	Communication	3	0	0	0	0	3.1	0.0%
Open Water	Cultural - Lacustrine	45.2	63	657.1	0	419	1,184.40	0.7%
	Cultural - Riverine	25.1	92.5	0	0	42	159.6	0.1%
	Lacustrine	0	48.4	9.3	0	75	132.7	0.1%
	Natural Lakes and Ponds	0	20.9	1.2	0	6	28.1	0.0%
	COLUMN TOTAL	43,767.2	90,576.3	2,667.4	2,431.1	20,047.0	**159,489.0**	
	COLUMN PERCENT	27.4%	56.8%	1.7%	1.5%	12.6%		

Table 2-2. General land cover (acres) within the Plan Area by designated use under the HCP. Percentages reported are row or column totals divided by the grand total (159,489 acres).

CATEGORY	DEVELOPMENT	PRESERVATION	VERY LOW DENSITY	BASE ZONING	ELIGIBLE FOR INCLUSION	ROW TOTAL	ROW PERCENT
Active Agriculture	37,423.0	25,543.2	501.8	1,780.8	11,814.0	77,062.8	48.3%
Native Wetland	2,442.4	49,695.0	733.1	629.8	5,043.0	58,543.3	36.7%
Native Upland	1,803.9	10,220.5	446.6	16.3	734.0	13,221.3	8.3%
Other	1,706.5	4,744.6	304.0	0.3	1,363.0	8,118.4	5.1%
Existing Development	321.0	148.3	14.2	3.9	551.0	1,038.4	0.7%
Open Water	70.3	224.8	667.6	0.0	542.0	1,504.7	0.9%
COLUMN TOTAL	43,767.2	90,576.3	2,667.4	2,431.1	20,047.0	**159,489.0**	
COLUMN PERCENT	27.4%	56.8%	1.7%	1.5%	12.6%		

Table 2-3. Calculations for prorating the distribution of up to 39,973 acres of development (the development cap in the HCP) among cover classes using the Proportional method for some species-specific effects analyses (see section 2.1.4). Column "G" reports the acres of each cover class that we attribute to development for such analyses.

GENERAL CATEGORY	COOPERATIVE LAND COVER CLASS	A DEVELOP-MENT & MINING	B BASE ZONING	C ELIGIBLE LANDS	D RURAL LANDS WEST	E A + B + C - D	F E*((Cap-D_{total})/E_{total}))	G D + F	H A + B + C - G
Active Agriculture	Orchards/Groves	18,482	0	7,772	0	26,254	15,542	15,542	10,711
	Cropland/Pasture	14,549	698	2,496	2,923	14,820	8,774	11,697	6,046
	Improved Pasture	4,393	1,082	1,546	600	6,421	3,801	4,401	2,620
	Other Agriculture	0	0	0	0	0	0	0	0
Native Wetland	Marshes	1,007	0	1,335	60	2,282	1,351	1,411	931
	Cypress	141	0	1,270	22	1,389	822	844	567
	Prairies and Bogs	708	0	1,152	64	1,796	1,063	1,127	733
	Freshwater Forested Wetlands	110	0	662	8	764	452	460	312
	Isolated Freshwater Swamp	168	0	173	15	326	193	208	133
	Wet Flatwoods	135	53	20	10	198	117	127	81
	Cypress/Tupelo	142	0	262	20	384	228	248	157
	Isolated Freshwater Marsh	9	536	102	0	648	384	384	264
	Strand Swamp	0	1	14	0	15	9	9	6
	Other Hardwood Wetlands	4	0	53	0	57	34	34	23
	Dome Swamp	0	37	0	0	37	22	22	15
	Hydric Hammock	0	2	0	0	2	1	1	1
	Freshwater non-Forested Wetlands	6	0	0	0	6	3	3	2
	Other Coniferous Wetlands	11	0	0	0	11	6	6	4
Native Upland	Mesic Flatwoods	938	0	314	36	1,216	720	756	496
	Mixed Hardwood-Coniferous	240	0	165	0	405	240	240	165
	Mesic Hammock	417	16	167	1	600	355	356	245
	Shrub and Brushland	207	0	88	56	239	141	197	97
	Palmetto Prairie	1	0	0	0	1	1	1	1
	Scrubby Flatwoods	0	0	0	0	0	0	0	0
	Scrub	0	0	0	0	0	0	0	0
Other	Rural (Rural Open Lands)	1,415	0	1,153	124	2,444	1,447	1,571	997
	Exotic Plants	292	0	59	72	279	165	237	114
	Fallow Orchards	0	0	102	0	102	60	60	42
	Extractive	0	0	34	0	34	20	20	14
	Cultural - Terrestrial	0	0	15	0	15	9	9	6
	Bare Soil/Clear Cut	0	0	0	0	0	0	0	0
	SUBTOTAL	43,376	2,427	18,954	4,011	60,746	35,962	39,973	24,784
Existing Development	Low Intensity Urban	179	0	303	31				
	Transportation	105	4	200	30				
	High Intensity Urban	33	0	48	0				
	Utilities	1	0	0	0				
	Communication	3	0	0	0				
Open Water	Cultural - Lacustrine	45	0	419	2				
	Cultural - Riverine	25	0	42	0				
	Lacustrine	0	0	75	0				
	Natural Lakes and Ponds	0	0	6	0				
	SUBTOTAL	391	4	1,093	63				
	COLUMN TOTAL	43,767	2,431	20,047	4,074				

Table 2-4. Example of the Reasonable Maximum Impact method for attributing up to 39,973 acres of development among cover classes in some species-specific effects analyses. This example is for a hypothetical species associated with a mix of agricultural and native upland cover classes, which are ranked in order of importance to the species. The right-most column tallies the cumulative acreage of potential development in rank order. We would not attribute full development to the 11th ranked cover class in this example, because its acreage in the development envelope, plus that of the higher-ranked classes, exceeds the 39,973-acre cap by 16,167 acres.

COOPERATIVE LAND COVER CLASS	DEVELOP-MENT & MINING	BASE ZONING	ELIGIBLE LANDS	TOTAL	RANK	CUMULATIVE CONTRITUBION TO DEVELOPMENT CAP
Improved Pasture	4,393	1,082	1,546	7,021	1	7,021
Palmetto Prairie	1	0	0	1	2	7,023
Scrubby Flatwoods	0	0	0	0	3	7,023
Mesic Flatwoods	938	0	314	1,252	4	8,275
Shrub and Brushland	207	0	88	295	5	8,570
Mixed Hardwood-Coniferous	240	0	165	405	6	8,975
Mesic Hammock	417	16	167	601	7	9,575
Scrub	0	0	0	0	8	9,575
Rural (Rural Open Lands)	1,415	0	1,153	2,568	9	12,143
Cropland/Pasture	14,549	698	2,496	17,743	10	29,886
Orchards/Groves	18,482	0	7,772	26,254	11	39,973
ALL OTHER CLASSES	3,125	634	6,346	10,105		
COLUMN TOTAL	43,767	2,431	20,047	66,245		

Table 2-5. Phases, activities, sub-activities, and stressors associated with development activity under the HCP (source: HCP Appendix A).

PHASE	ACTIVITY	SUB-ACTIVITY	STRESSOR(S)
Pre-construction	Listed species surveys	Pedestrian transects	Disturbance; noise
		ATV/ORV surveys	Disturbance; noise
	Land surveying	Pedestrian transects	Disturbance; noise
		ATV/ORV vehicle use	Disturbance; noise
	Geotechnical investigations	Small drill rig driving	Disturbance; noise
		Small drill rig operation	Disturbance; noise; fuel/oil
Construction (horizontal)	Land/vegetation clearing	Row crop "clearing"	No replanting; disturbance; noise
		Citrus clearing	Habitat loss; disturbance; noise
		Pasture clearing	Habitat loss; disturbance; noise
		Native herbaceous clearing	Habitat loss; disturbance; noise
		Native forested clearing	Habitat loss; disturbance; noise
		Exotic vegetation clearing	Disturbance; noise
		Vegetation piling/burning	Disturbance; noise; smoke
	Earth moving/grading	Excavation	Noise; human disturbance
		Bulldozing	Noise; human disturbance
		Grading	Noise; human disturbance
		Compacting	Noise; human disturbance
		Sedimentation control berms	Noise; human disturbance
		Sedimentation control fencing	Noise; human disturbance
	Dewatering	Excavation (receiving reservoir)	Noise; human disturbance
		Construction excavation	Noise; human disturbance
		Pumping	Noise; human disturbance
	General Construction	Small vehicle traffic	Noise; human disturbance
		Delivery trucks/vehicles	Noise; human disturbance
		Heavy equipment (cranes, etc.)	Noise; humans; fuel/oil
		Staging areas	Noise; humans; fuel/oil
		Fuel/oil storage	Noise; humans; fuel/oil; odor
		Concrete batch plants	Noise; humans; fuel/oil
		Asphalt paving (parking)	Noise; humans; fuel/oil
	Internal road construction	Road bed grading	Noise; humans; fuel/oil
		Road drainage grading	Noise; humans; fuel/oil
		Road bed compaction	Noise; humans; fuel/oil
		Road paving	Noise; humans; fuel/oil
		Bridges (wetland crossings)	Noise; humans
	Electrical utilities	High-voltage transmission lines	Noise; human disturbance
		Electrical substations	Noise; human disturbance
		Electrical distribution lines	Noise; human disturbance
		Underground electrical	Noise; human disturbance
	Water and sewer utilities	Water supply wells	Noise; humans; fuel/oil
		Water treatment plants	Noise; human disturbance
		Water supply lines	Noise; human disturbance
		Sanitary sewer lines	Noise; human disturbance
		Stormwater sewers	Noise; human disturbance
Construction (vertical)	Building construction	Framing	Noise; human disturbance
		Interior construction	Noise; human disturbance
		Exterior construction	Noise; human disturbance
	Road lighting/signage	Streetlights, signals installation	Noise; human disturbance
	Recreational construction	Recreational fencing (fields)	Noise; human disturbance
		Recreational lighting install	Noise; human disturbance

Table 2-6. Phases, activities, sub-activities, and stressors associated with mining activity under the HCP (source: HCP Appendix A).

PHASE	ACTIVITY	SUB-ACTIVITY	STRESSOR(S)
Pre-construction	Listed species surveys	Pedestrian transects	Disturbance; noise
		ATV/ORV surveys	Disturbance; noise
	Land surveying	Pedestrian transects	Disturbance; noise
		ATV/ORV vehicle use	Disturbance; noise
	Geotechnical investigations	Drill rig driving	Disturbance; noise
		Drill rig operation	Disturbance; noise; fuel/oil
Mining	Land/vegetation clearing	Row crop "clearing"	No replanting; disturbance; noise
		Citrus clearing	Habitat loss; disturbance; noise
		Pasture clearing	Habitat loss; disturbance; noise
		Native herbaceous clearing	Habitat loss; disturbance; noise
		Native forested clearing	Habitat loss; disturbance; noise
		Exotic vegetation clearing	Disturbance; noise
		Vegetation piling/burning	Disturbance; noise; smoke
	Earth materials excavation	Use of explosives (if necessary)	Noise (sudden)
		Excavation	Noise; human disturbance
		De-watering/pumping	Noise; human disturbance
		Onsite hauling	Noise; human disturbance
		Stockpiling	Noise; human disturbance
		Sedimentation control berms	Noise; human disturbance
		Sedimentation control fencing	Noise; human disturbance
	Processing plant construction	Heavy equipment (cranes, etc.)	Noise; humans; fuel/oil
		Delivery trucks/vehicles	Noise; humans
		Staging areas	Noise; humans; fuel/oil
		Small vehicle traffic	Noise; humans
		Fuel/oil storage	Noise; humans; fuel/oil; odor
	Internal mine road construction	Road bed grading	Noise; humans; fuel/oil
		Road drainage grading	Noise; humans; fuel/oil
		Road bed compaction	Noise; humans; fuel/oil
		Paving	Noise; humans; fuel/oil
		Bridges (wetland crossings)	Noise; humans
	Electrical utilities	High-voltage transmission lines	Noise; human disturbance
		Electrical substation	Noise; human disturbance
		Electrical distribution lines	Noise; human disturbance
Conversion to Development	Earth moving/grading	Excavation	Noise; human disturbance
		Bulldozing	Noise; human disturbance
		Grading	Noise; human disturbance
		Compacting	Noise; human disturbance
		Sedimentation control berms	Noise; human disturbance
		Sedimentation control fencing	Noise; human disturbance
	Construction	See Table 2-3	
Reclamation activities	Earth moving/grading	Grading	Noise; human disturbance
		Redistribute soils	Noise; human disturbance
	Revegetate per reclamation plan	Planting	Noise; human disturbance
	Post-reclamation monitoring	Onsite monitoring per plan	Human disturbance

Table 2-7. Calculations for prorating the distribution of up to 10% clearing of native land cover in the Very Low Density use areas, which we show as a conversion to Rural Structures.

GENERAL CATEGORY	COOPERATIVE LAND COVER CLASS	Existing Acres	Acres following up to 10% clearing	Acres Cleared
Agriculture	Improved Pasture	501.8	501.8	
Native Wetland	Marshes	123.9	111.5	12.4
	Cypress	17.4	15.7	1.7
	Prairies and Bogs	97.6	87.8	9.8
	Freshwater Forested Wetlands	357.2	321.5	35.7
	Isolated Freshwater Swamp	40.4	36.4	4.0
	Wet Flatwoods	3.2	2.9	0.3
	Cypress/Tupelo	69.7	62.7	7.0
	Isolated Freshwater Marsh	1.7	1.5	0.2
	Other Hardwood Wetlands	22.1	19.9	2.2
Native Upland	Mesic Flatwoods	112.3	101.0	11.2
	Mixed Hardwood-Coniferous	135.0	121.5	13.5
	Mesic Hammock	61.4	55.2	6.1
	Shrub and Brushland	138.0	124.2	13.8
Other	Rural (Rural Open Lands)	240.9	240.9	
	Rural Structures	0.0	118.0	
	Exotic Plants	1.9	1.9	
	Extractive	61.2	61.2	
Existing Development	Transportation	13.8	13.8	
Open Water	Cultural - Lacustrine	657.1	657.1	
	Lacustrine	9.3	9.3	
	Natural Lakes and Ponds	1.2	1.2	
	COLUMN TOTAL	**2,667.0**	**2,667.0**	**118.0**

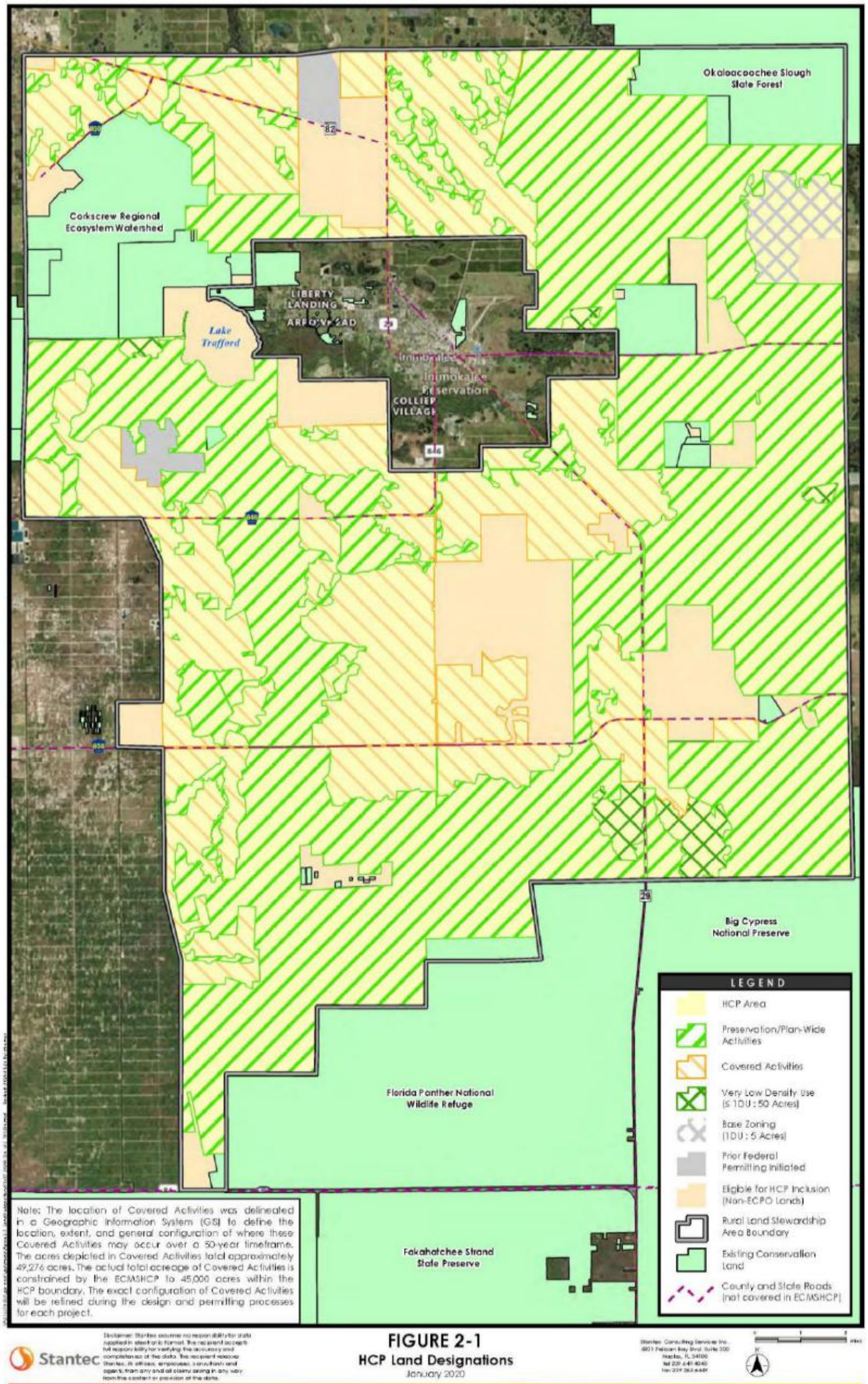


Figure 2-1. Land use designations of the HCP Plan Area (source: HCP Figure 2-1).

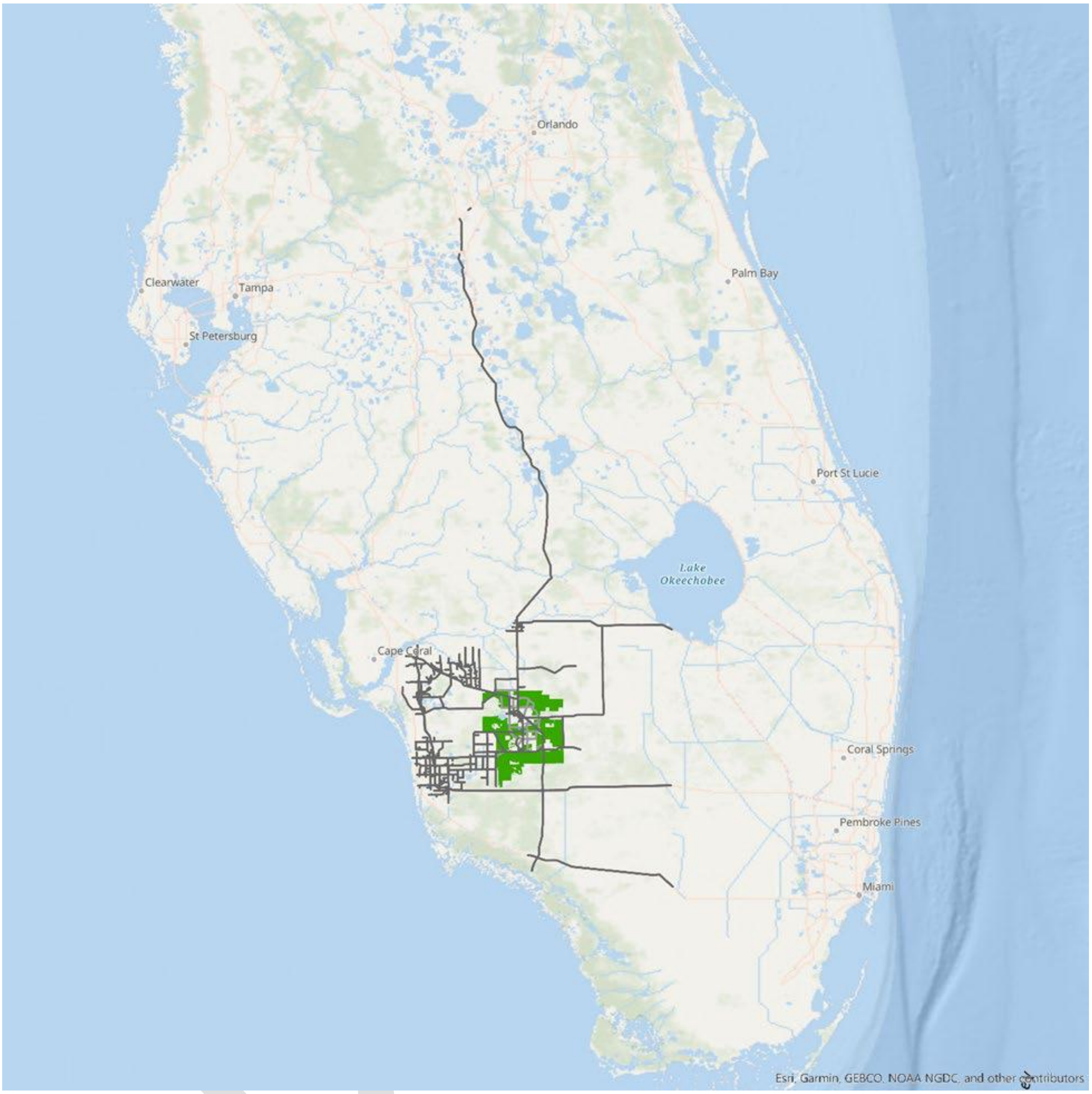


Figure 2-2. Extent of the Action Area for this consultation, which includes:

1) the 159,489-acre Plan Area (green); and
2) 5,072 discrete road segments through and extending beyond the Plan Area (black). Together the road segments equal 1,825 miles.

3 TRAFFIC PREDICTIONS AND SOURCES OF CUMULATIVE EFFECTS

We identified in section 2.8 the collective activities of future residents of new developments in the Plan Area as activities that are not a part of, but would be caused by, the development activities of the HCP, for which the Applicants seek ITPs (the Federal Action). Changes caused by the activities of future residents include an increase in traffic on existing roads. Section 3.1 below describes the analyses we referenced in section 2.1.2 that support extending the Action Area ("all areas affected by the action") beyond the Plan Area to include various roads through and outside of the Plan Area, because the Action Area is defined by the spatial extent of action-caused changes. We reference section 3.1 within the "Effects of the Action" subsections of the species-specific sections.

In addition to predicting the consequences to species caused by activities that are not part of, but would be caused by, the Federal action under consultation, a BO/CO must predict the consequences to species caused by future non-Federal activities within the action area, *i.e.,* cumulative effects. "Cumulative effects are those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation" (50 CFR §402.02).

The ECPO Applicants own 139,442 acres (87.4%) of the Plan Area, and the HCP proposes activities on these lands that we analyze in this BO/CO. We do not expect additional non-federal actions unrelated to the proposed HCP on the ECPO lands. The Applicants include an additional 20,047 acres owned by others as lands "Eligible for Inclusion" in the HCP. As we noted in section 2.6, the addition of Eligible lands to the HCP is uncertain, but it is an explicit provision of the HCP. Therefore, we consider the Eligible lands part of the Plan Area, and include these lands in our analyses of the effects of the Covered Activities on up to 39,973 acres (45,000 acres minus the permitted development of Ave Maria) within the Plan Area.

Land-use provisions of the Collier County RLSA (see section 2.1.1) apply to the Plan Area which includes Eligible lands. The ratios of developed areas to rural/natural areas prescribed under the RLSA, pending the incorporation of Amendments to the Land Development Code approved by the Collier County Board of Commissioners, effectively limit the extent of development within its boundaries to about 45,000 acres, of which 39,973 acres remain undeveloped. In the species-specific sections of this BO/CO, we predict the consequences of developing up to 39,973 acres within the Plan Area using the methods we described in section 2.1.4 ("Methods for Estimating the Extent of Development by Habitat Types"). Whether future development on the Eligible lands occurs as part of the HCP or independent of the HCP, our analyses address development on Eligible Lands.

Another reason we do not expect non-Federal development in the Plan Area as a source of cumulative effects is that native wetlands cover about a quarter (25.2%) of the Eligible lands (see Table 2-2). Although the construction of a single-family residence may occur without affecting wetlands, developments of a larger scale (*e.g.,* more than 100 acres) and associated infrastructure would likely require permits under section 404 of the Clean Water Act. This permitting authority would create a Federal nexus for most new development in the Eligible lands, which we do not consider as cumulative effects under ESA §7. The Federal nexus would mean that the Service will likely review these projects and request minimization and compensation measures. Only a small portion of projects would not have a Federal nexus (about 25 percent in our experience).

Because more than 39,973 acres of future development in the Plan Area without a Federal nexus is unlikely, the sole source of cumulative effects that we have identified for this BO/CO is future vehicular traffic on the roads we include in the Action Area. Future traffic will include vehicles associated with the developments of the HCP and vehicles associated with regional population growth. We consider the former as changes caused by the Action, and the latter as changes caused by future non-Federal activities (*i.e.,* sources of cumulative effects). In the following section (3.1), we describe the analyses for predicting both changes. The changes made to widen roads or create new public roads to accommodate increased traffic are not considered part of cumulative effects because they will likely have a Federal nexus. This means the Service will likely consult on these projects and have the opportunity to request minimization and compensation measures.

3.1 Traffic Analyses

Continuing human population growth in southwest Florida drives a demand for new residential and commercial development. The location and density of development, such as the development under the HCP, directly influences the distribution and volume of traffic on existing public roads, as well as the construction of additional lanes to existing roads and entirely new transportation corridors. The improvement of existing corridors and construction of new roadways can likewise spur new development. The distribution and volume of traffic is relevant to this BO/CO, because panther vehicle collisions are a leading cause of Florida panther mortality, and affects other Covered Species as well. All road segments receiving a predictable increase in traffic volume that would not occur but for the level of HCP development in the Plan Area satisfy the definition of "action area" for consultation purposes (see section 2.1). This section explains how we predicted a reasonably certain increase in traffic caused by the HCP developments and caused by future regional growth unrelated to the HCP. Our analyses in this BO do not fully capture all of the roadway projects that may influence traffic in the action area or to whom additional panther mortality (or some proportion thereof) from those projects may be attributable. However, our analysis does evaluate the effects of traffic projected by the applicants from HCP-attributable activities above the current baseline and proposed and funded FDOT projects (D1IM traffic model). Other traffic effects are considered in the Cumulative Effects section and are detailed in Chapter 5 and Appendix F of this BO.

<u>Traffic Model</u>

In our draft Environmental Impact Statement (EIS) for the HCP (USFWS 2018), we predicted changes in traffic volume on existing roads within a defined Transportation Analysis Area, which encompassed the entire Plan Area. These predictions relied upon the Florida Department of Transportation (FDOT) District 1 Regional Planning Model (D1RPM). D1RPM is a tool for predicting the distribution and volume of traffic on the road network of the 12 southwest Florida counties included within FDOT District 1. D1RPM is a "trip-based" model that predicts traffic from a spatially explicit distribution of population and employment in 5,628 traffic analysis zones (TAZs) delineated for District 1. The current version of D1RPM is calibrated with socioeconomic data and observed traffic count data for the base year of 2010. Model users predict future traffic conditions by altering the base-year socioeconomic data. Although D1RPM generates multiple outputs, we use the results expressed as average annual daily traffic (AADT) on discrete road segments.

FDOT compiled a set of socioeconomic data to represent expected population and employment in all of the D1RPM TAZs for the year 2040. For our EIS, we substituted specific socioeconomic projections for the TAZs that are within the Plan Area based on the HCP. These substitutions anticipated development at a density comparable to that in Ave Maria on 39,973 acres of the Plan Area. We estimated that the HCP alternative would support about 72,200 residential/commercial units and 21,300 jobs. The current population of the 12 counties of FDOT District 1 is about 2.7 million (FDOT 2019), and the projected 2040 population is about 4.1 million (FDOT 2016). The new developments of the Plan Area would constitute about 1.8% of the 2040 District 1 population.

D1RPM distributes trips on the road network using a "gravity" model that generates trips between TAZs as a function of the population/employment "mass" of each TAZ and the distance between TAZs. Routes connecting TAZs of greater mass and proximity receive more trips than routes connecting widely separated TAZs of lesser mass. The model frequently computes small contributions (as few as 1 trip) to road-segment AADT from far-away TAZs in the 12-county District. However, this TAZ-specific precision of the model is an artifact of its deterministic gravity calculations. FDOT calibrates the model using traffic counting devices on road segments, which cannot identify the TAZ origin of the vehicles counted. The D1RPM estimates of AADT are verifiable and relatively accurate (FDOT 2016). The accuracy of TAZ-specific contributions to road segment AADT is not verifiable, but is likely highest for nearby TAZs with the greatest population/employment.

<u>Adding Road Segments to the Action Area</u>

To identify road segments that satisfy the "action area" definition for this BO/CO, we must predict the increase in traffic relative to current conditions that an increase in population and employment in the TAZs of the Plan Area is reasonably certain to cause. We obtained from FDOT observed (not modeled) AADT data for road segments in 2017 to represent current conditions. Using our population/employment projections for the Plan Area TAZs and the FDOT 2040 data for all other TAZs, D1RPM attributes trips to/from the Plan Area TAZs in the AADT calculations for road segments in 11 of the 12 counties of District 1 (all except Okeechobee County). However, the Plan Area TAZs account for a small portion of AADT (less than 100 daily trips) on hundreds of the road segments that receive thousands of daily trips under both current conditions and projected 2040 conditions.

The full geospatial data representation of the FDOT 2040 D1RPM road segment volume predictions, including a table of the road segment attributes, can be downloaded from the following internet location in the Service's public-facing administrative record repository: https://ecos.fws.gov/ServCat/Reference/Profile/111968. This geospatial data can be viewed in Esri ArcMap–compatible applications. The FDOT 2040 D1RPM road segments are also viewable on computers and smart phones, via Esri's Arc GIS Online web mapping service, at the following internet location:

https://fws.maps.arcgis.com/apps/webappviewer/index.html?id=66e4a31663c54ca9b9f6591f4b8b8683.

We do not consider the projected population and employment of the Plan Area TAZs for 2040 high enough (1.8% of the projected 2040 District 1 population) to cause a reasonably certain increase in traffic at great distances from the Plan Area. The deterministic "gravity" simulation of traffic in D1RPM provides no statistical basis for quantifying confidence in TAZ-specific contributions to segment-specific AADT predictions. Therefore, we must choose AADT thresholds for filtering the model results to identify road segments that new developments in the Plan Area are reasonably certain to affect species during the course of the Action. The 100-trip threshold was selected as an appropriate Action Area criterion based on Charry and Jones (2009) analysis of multiple wildlife/traffic interaction studies. Charry and Jones 2009 analysis determined that the onset impacts to wildlife could be detected in traffic volume increases between 100 to 500 vehicles per day. We consider road segments for which the D1RPM attributes to the Plan Area TAZs a 2040 AADT increase of 100 trips, or greater, as areas to be affected indirectly by the action. Of the 65,265 road segments described in the D1RPM, 5,072 segments met the 100 AADT, or larger, traffic volume increase threshold (Table 3-1). The addition of these roads expands the Action Area beyond the immediate area involved in the Action. Figure 2-2, which we referenced in section 2.1 ("Action Area"), is a map showing the 5,072 road segments that meet these criteria (see D1RPM 2040 attribute table in the Service's public-facing administrative record repository: https://ecos.fws.gov/ServCat/Reference/Profile/111968).

Extrapolating D1RPM Results Beyond 2040

To estimate the influence of traffic from non-HCP sources we extrapolated the traffic growth trend for non-HCP traffic volumes to 2070. To extrapolate, we subtracted the 2014 thru 2018 AADT from the 2040 Non-HCP AADT, divided this by the intervening time interval (22 years) to get a ratio of traffic increase per year, then multiplied the result by 52 to approximate the change in traffic that would occur from non-HCP sources between 2018 and 2070.

3.2 Tables and Figures

Table 3-1. Summary table of the number and total distance of D1RPM road segments included in the Action Area.

D1RPM segments	Number of segments	Total distance in miles
Non-Action Area	60,193	20,185
Action Area	5,072	1,835
Grand Total	65,265	22,020

4 Florida Bonneted Bat

This section provides the Service's biological opinion of the Action for the Florida bonneted bat (FBB) in sections 4.1 through 4.5 and the Service's conference opinion of the Action for the Florida bonneted bat proposed critical habitat in sections 4.6 through 4.10.

4.1 Status of Florida Bonneted Bat

This section summarizes best available data about the biology and current condition of the FBB (*Eumops floridanus*) throughout its range that are relevant to formulating an opinion about the Action. The Service published its decision to list the FBB as endangered on October 3, 2013 (78 FR 61004). Please refer to the final rule for additional information about the status of the FBB.

4.1.1 Species Description

The FBB is a member of the Molossidae (free-tailed bats) family within the order Chiroptera, and is the largest bat in Florida. The common name "bonneted bat" refers to the species' large broad ears, which project forward over the eyes, and join at the midline of the head. Wings of the members of the genus *Eumops* are among the narrowest of all molossids and are well-adapted for rapid, prolonged flight (Freeman 1981). The FBB's fur is short and glossy, with hairs sharply bicolored with a white base (Timm and Genoways 2004). Primary pelage color is highly variable, from black to brown to brownish-gray or cinnamon brown with ventral pelage paler than dorsal (Timm and Genoways 2004).

4.1.2 Life History

The FBB does not seasonally hibernate or enter short-term periods of torpor. Active year-round, the species is likely dependent upon a constant food supply to maintain its high metabolism. FBBs feed on flying insects of the following orders: Coleoptera (beetles), Diptera (true flies), Hemiptera (true bugs), and Lepidoptera (moths) (Belwood 1981; Belwood 1992; Marks 2013). Foraging in open spaces, the FBB uses echolocation to detect prey at relatively long range, roughly 10–16 feet (Belwood 1992). Individuals leave roosts to forage after dark, seldom occur below 33 feet in the air, and produce loud, audible calls when flying (Belwood 1992; Best *et al.* 1997; Marks and Marks 2008a).

Like other molossids, the FBB is capable of low-energy, swift, long-distance travel from roost site to foraging areas (Norberg and Rayner 1987). Data from a few satellite tagged FBB indicated that individuals foraged several miles (maximum 24 miles) from their roosts and covered long distances in one night (maximum 56 miles) (Ober 2016; E. Webb, pers. comm. 2018a-b).

Habitat for the FBB consists of foraging areas and roosting sites, both of which may occur in a broad array of land cover types. Researchers have recorded echolocation calls in the following land cover types:

- pine flatwoods, including wet, mesic, and scrubby flatwoods, and pine rocklands (Belwood 1981; Arwood 2012, F. Ridgley, pers. comm. 2013a–d; 2014a–c);
- freshwater forested wetlands, including cypress, mangrove, and other swamps (Smith 2010; Arwood 2012);

- mesic and rockland hardwood hammocks (Smith 2010);
- lakes, ponds, rivers, and canals (Marks and Marks 2008b);
- rural and agriculture lands, including groves, tropical gardens, crop-based agriculture (Bailey *et al.* 2017);
- urban landscapes, including residential areas, disturbed nonnative areas, and developed park lands (S. Snow, pers. comm. 2011a–b; Timm and Genoways 2004; Gore *et al.* 2015).

Bailey *et al.* (2017) detected FBB in all major land cover types surveyed by acoustic methods (agriculture, developed, upland, and wetland). This study developed occupancy models to explain the influence of various environmental factors on FBB detection rates. The researchers found that the extent of developed areas at acoustic monitoring locations had the largest effect on bat occupancy probabilities among the variables tested, with occupancy probability decreasing with increasing amount of developed land. Agriculture had a positive effect on occupancy, with occupancy increasing with the amount of crop-based agriculture. This study found that FBB did not make preferential use of pine forests.

Female bats rear flightless young in their day roosts, which provide protection from predators (Marks and Marks 2008b). For most bats, the availability of suitable roosts is an important and limiting factor (Humphrey 1975). FBBs roost in various sheltered situations well above the ground; therefore natural roosting habitat may include any area with tall live or dead trees (snags) that have cavities, hollows, deformities, decay, crevices, or loose bark. FBB will also use artificial structures for roosts, such as bat houses, utility poles, and buildings. Bat houses typically support small numbers of FBB, but emergence counts at two houses sharing a single pole detected 44 individuals (J. Myers, pers. comm. 2014a, 2014c).

Natural FBB roosts are difficult to locate. At this time, we are aware of only 19 natural roost sites. At these sites, FBBs roost singly or in colonies consisting of a male and several females (sometimes called a harem in the literature), in live or dead pines, cypress, and palms (Belwood 1992; R. Arwood, pers. comm. 2015; Ober et al. 2018). Ober et al. (2017) suggest that FBB colony sizes are generally small, so that males can successfully defend them.

At a roost located on the Florida Panther National Wildlife Refuge, which is adjacent to the Plan Area, Braun de Torrez et al. (2016) counted 12 FBB during evening emergence counts, but suspected that others remained in the cavity. Ober et al. (2017) investigated the social organization of FBBs roosting in bat houses in southwest Florida. The average roost size was 10 individuals, with a persistent (multiple seasons) harem social structure (1 male, multiple females).

The maternity season for most bat species in Florida occurs from mid-April through mid-August (Marks and Marks 2008a). The FBB is a subtropical species, and available data suggest the species is polyestrous (having more than one period of estrous in a year) (Timm and Genoways 2004; Florida Bat Conservancy 2005; Ober et al. 2017). Energy demands on females increase during the maternity season, as females make multiple foraging excursions to support lactation (Kurta *et al.* 1989; Kurta *et al.* 1990; Kunz *et al.* 1995; Marks and Marks 2008a; H. Ober, pers. comm. 2014a). Observations of pregnant and post-lactating females in late August suggest a longer maternity season for FBB compared to other Florida bats (H. Ober, pers. comm. 2014b; J. Myers, pers. comm. 2014a–c). Reduced insect populations in urban areas may make it difficult for females to successfully rear offspring in urban areas (Kurta *et al.* 1990; Kurta and Teramino 1992).

The FBB has low fecundity with a litter size of one pup annually (Florida Bat Conservancy 2005; Timm and Arroyo-Cabrales 2008). Wilkinson and South (2002) suggest a lifespan of 10–20 years for bats the size of FBBs, and Gore et al. (2010) estimate an average FBB generation time of 5–10 years. The FBB is not migratory, but may seasonally shift roosting sites and foraging areas (Timm and Genoways 2004; FWC, pers. comm. 2018).

4.1.3 Numbers, Reproduction, and Distribution

Unlike most bat species, with ranges spanning several states or entire continents, the FBB occurs only within south and south-central Florida, which is one of the smallest distributions of any species of bat in the western hemisphere (Belwood 1992; Timm and Genoways 2004).

Numerous acoustic surveys for the FBB conducted in the past decade suggest that where the species is detected, abundance is low (Marks and Marks 2008a; 2012; FWC 2011a; FWC 2011b; Timm *in litt.* 2012). Bailey *et al.* (2017) conducted acoustic surveys for FBB in 15 of 16 Florida counties of "known or suspected" occurrence (no points surveyed in Monroe County). This study detected the species at 60 of 330 points monitored sunset to sunrise for several months in 2014 and 2015. Using an occupancy model that explained detection probability as a function of environmental variables, this study estimated that FBB were likely present in > 20% of the 16-county, 18,401-$mile^2$ study area (>3,680 $miles^2$). The local abundance of developed areas had the strongest effect among the environmental variables examined; occupancy probability decreased with increasing amount of developed land. Occupancy probability increased with increasing amount of crop-based agriculture in the local area. Figure 4-1 shows the results of the occupancy model.

NatureServe (2019) classifies the FBB as a G1 species, *i.e.,* critically imperiled globally due to extreme rarity (5 or fewer occurrences, or fewer than 1,000 individuals), or due to extreme vulnerability to extinction by natural or manmade factors. Based upon inferences from publicly available data, the 2016 IUCN Red List of Threatened Species list the species as "vulnerable" with a population size in the low hundreds to the low thousands (well below 10,000) (Solari 2016). Some FBB researchers suggest a population size of less than 1,000 individuals (Marks and Marks 2008a; FWC 2011b; Marks and Marks 2012).

New information about the species' range, roost colony sizes, and occurrence data (FWC and other sources, unpublished data) suggests that 1,000 individuals is likely an underestimate. The Service estimates the range-wide number of mature individuals at about 2,000 adults and the extent of occurrence at 8,734 km^2 (3,372 $mile^2$), or an overall density of 0.6 FBB per $mile^2$ (Ziewitz 2019).

4.1.4 Conservation Needs and Threats

Habitat loss

Due to the critical importance and limited availability of roost sites, the loss of forest habitat is considered a threat to the FBB (Belwood 1992; Timm and Arroyo-Cabrales 2008). Removing dead or live trees with cavities during forest management (*e.g.*, thinning, pruning), prescribed fire, exotic species treatment, or trail maintenance may inadvertently remove roost sites. Loss of an active roost, especially when occupied by pregnant or lactating females, can strongly affect a small local population with low fecundity (probably 1 pup per mature female annually). Accordingly, managing landscapes to supply suitable roosting sites is the species' primary conservation need.

In urban areas, removing or modifying buildings or trees that provide roost sites may also harm FBB (Timm and Arroyo-Cabrales 2008). Robson (1989) lists routine landscaping, removing dead pine or royal palm trees, pruning or trimming trees (especially cabbage palms), sealing barrel-tile roof shingles with mortar, destroying abandoned buildings, and clearing native vegetation as potential causes of roost destruction.

Belwood (1992) stated that tree cavities were rare in southern Florida and that competition for available cavities from native wildlife (*e.g.*, southern flying squirrel, red-headed woodpecker, corn snake) was intense. Competition for cavities has probably increased since 1992, due to a continued loss of cavity trees and a continued influx of non-native or introduced species, which also vie for limited cavities for roosting or nesting.

Pesticides and contaminants

The impacts of pesticides and other environmental contaminants on bats are largely unstudied, including the FBB. The FBB forages at dusk and after dark, and its range includes urban areas that receive airborne mosquito control treatments, where direct exposure to these pesticides or through consuming insects with pesticide residues is likely to occur. Likewise, the use of pesticides by homeowners and agricultural operators may also expose FBB to various chemicals directly or through diet. In addition to the possible harmful effects of pesticide exposure, Robson (1989) suggested that mosquito control programs are contributing to reduced food availability for the FBB. Although adverse effects to FBB resulting from direct and indirect chemical exposure are plausible, we have no data that estimates the impact to FBB numbers, reproduction, or distribution.

Extreme weather and climate change

This species is vulnerable to weather events such as extreme cold and hurricanes, which may increase in frequency as the climate changes. Members of the *Mollossidae* family that inhabit the warmer temperate and subtropical zones incur much higher energetic costs for thermoregulation during cold weather events than those inhabiting northern regions (Arlettaz *et al.* 2000).

The high winds and falling trees of intense storms and hurricanes may directly kill FBB, destroy roost sites, expose individuals displaced from roost sites to predation following the storm, and reduce food availability (Timm and Genoways 2004; Marks and Marks 2008a; W. Kern, Jr. *in* *litt.* 2012; R. Timm, *in litt.* 2012). The hurricane season overlaps with the FBB's extended breeding season, which increases the likelihood of reduced recruitment as an additional impact of storms (Marks and Marks 2008a). However, storms of lesser intensity may also create new roosting opportunities, if dead or damaged trees remain on the landscape afterwards.

Sea level rise is expected to shrink habitat availability for many south Florida species (Saha *et al.* 2011). Three subpopulations of the FBB occur in at-risk coastal locations (Gore *et al.* 2010). Within the species' range, low-lying areas in Collier, Lee, Miami-Dade, and Monroe Counties appear most vulnerable to inundation and saltwater intrusion.

4.1.5 Tables and Figures

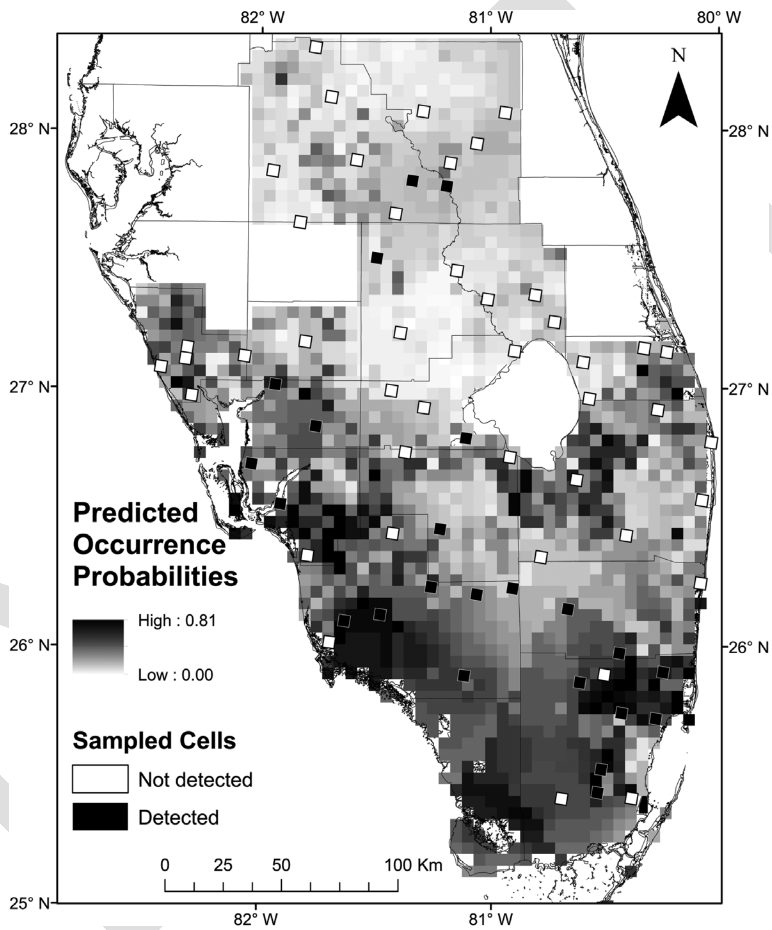


Figure 4-2. Map showing predicted probability of FBB occurrence in 16 Florida counties, and areas sampled by acoustic methods for FBB presence. Black- and white-outlined cells show where FBB were and were not detected, respectively. Source: Bailey *et al.* (2017).

4.2 Environmental Baseline for Florida Bonneted Bat

This section describes the current condition of the FBB in the Action Area without the consequences to the listed species caused by the proposed Action.

4.2.1 Action Area Numbers, Reproduction, and Distribution

All natural or vegetated land cover classes present in the Plan Area may support FBB foraging activity, including native uplands, wetlands, open waters, and agricultural areas (Table 2-1). Using our range-wide density estimate of 1 adult FBB per 1,079 acres (section 4.1.3), the 159,489-acre Plan Area would support about 148 adult FBB. Foraging may also occur in existing developed areas to some extent. Forested land cover types, both upland and wetland, are the most likely to support natural roost sites. We have no data about FFB roosts in bat houses or buildings in the Plan Area. The Plan Area contains approximately 41,763 acres of roosting habitat (Table 4-1), mostly (84.7%) within the designated Preservation areas.

The Applicants did not conduct FBB surveys of the Plan Area during the development of the HCP; however, individuals have been detected through acoustic monitoring within and immediately outside of the Plan Area. Available data includes 3 locations within the Development and Mining designation of the Plan Area and over 50 detections within 5 miles of the Plan Area (various sources, unpublished data). Nearby, the FBB is known to occur in the Florida Panther National Wildlife Refuge, Corkscrew Swamp, and Okaloacoochee Slough State Forest.

The model of Bailey et al. (2017) attributes a variable, but generally moderate, probability of occurrence to portions of the Plan Area based on an analysis of acoustic detections and habitat conditions (Figure 4-1). The acoustic monitoring station located within the Plan Area for this range-wide study did not detect FBBs. Known roost sites occur within 1 mile of the Plan Area (*e.g.,* Braun de Torrez et al. 2016), but not within the Plan Area. Lacking data about roosts or other concentrations of FBB activity in the Plan Area, we attribute the same probability of occurrence to all areas of suitable habitat in the Plan Area.

FBB may roost singly or in harems of a single male and several females, and may shift roosts seasonally (section 4.1.2). Using a sex ratio of 1:1, the estimated Plan Area abundance of 148 FBB would consist of 74 females. Using an average harem size of 1 male and 9 females (Ober et al. 2017), 74 adult females would occupy about 8–9 colonial roosts. Smaller colonies would use more roosts, and larger colonies would use fewer roosts. Roosting singly, 148 FBB could use up to 148 roosts at any given time, but this is unlikely, given the current understanding of the species' social organization.

4.2.2 Action Area Conservation Needs and Threats

We expect current threats to the species range-wide, such as loss of active roosts and roosting habitat, to increase with increased development in the Plan Area. Maintaining native wetland and upland forested habitats to provide roost sites, as well as vegetated and open water areas to provide foraging opportunities, is the species' primary conservation need in the Plan Area.

4.2.3 Tables and Figures

Table 4-1. Acreage of FBB roosting habitat within the Plan Area.

COOPERATIVE LAND COVER CLASS (Florida bonneted bat roosting habitat)	DEVELOPMENT	PRESERVATION	VERY LOW DENSITY	BASE ZONING	ELIGIBLE FOR INCLUSION	Plan Area Total
Cypress	141	11,550	17	0	1,270	12,978
Freshwater Forested Wetlands	110	4,094	357	0	662	5,224
Isolated Freshwater Swamp	168	3,681	40	0	173	4,063
Wet Flatwoods	135	2,300	3	53	20	2,512
Cypress/Tupelo	142	1,787	70	0	262	2,261
Strand Swamp	0	1,743	0	1	14	1,758
Other Hardwood Wetlands	4	437	22	0	53	516
Dome Swamp	0	279	0	37	0	317
Hydric Hammock	0	117	0	2	0	119
Other Coniferous Wetlands	11	13	0	0	0	24
Mesic Flatwoods	938	6,026	112	0	314	7,391
Mixed Hardwood-Coniferous	240	2,241	135	0	165	2,781
Mesic Hammock	417	1,129	61	16	167	1,791
Scrubby Flatwoods	0	29	0	0	0	29
COLUMN TOTAL	2,308	35,427	819	110	3,100	41,763
COLUMN PERCENT	5.5%	84.8%	2.0%	0.3%	7.4%	

4.3 Effects of the Action on Florida Bonneted Bat

This section describes all reasonably certain consequences to the FBB that we predict the proposed Action would cause, including the consequences of other activities not included in the proposed Action that would not occur but for the proposed Action. Such effects may occur later in time and may occur outside the immediate area involved in the Action.

4.3.1 Development and Mining, Base Zoning, and Lands Eligible for Inclusion

The designated Development and Mining, Base Zoning, and Lands Eligible for inclusion (collectively, the development envelope of the HCP) encompass 66,245 acres, or 42% of the Plan Area. The cap on total development within the development envelope is 39,973 acres, or 25% of the Plan Area. We estimate Plan Area FBB numbers at about 148 adult FBBs (section 4.2.1), and expect the development footprint to support about $0.25 \times 148 = 37$ adults.

FBBs may forage in virtually all of the vegetated and open water cover classes of the Plan Area. FBB detections along Florida's east coast have declined as development has converted native and agricultural cover to residential/commercial uses (Gore 2010). FBB detection probability decreases with the local abundance of developed areas and increases with the local abundance of agricultural areas (Bailey *et al.* 2017; see section 4.1.3). Consistent with these observations, we expect that the conversion of vegetated land cover, both native and agricultural, to urban or mining uses would reduce FBB numbers in the Plan Area to some extent. However, the availability of suitable roosts is likely the key factor that limits FBB abundance on the landscape (see section 4.1.4).

FBBs are most likely to find natural roost sites in the forested cover classes of the Plan Area, both upland and wetland. Table 4-2 shows our application of the "proportional method" described in section 2.1.4, which estimates that development of up to 39,973 acres within the development envelope would convert up to 3,316 acres of forested habitats to residential, commercial, or mining uses. The designated Development and Mining areas contain 2,357 acres of forested habitats, which is the maximum loss of forest cover that could occur if development is confined entirely to these areas (*i.e.,* no substitution of Base Zoning or Eligible lands in the development cap).

The loss of 2,357–3,316 acres of forest cover from the development envelope would reduce Plan Area forest cover by 5.6–7.9 percent. We expect Plan Area forests to support 8–9 colonial roost sites for a reproductive harem (1 male, multiple females) (section 4.2.1). The percentage loss of forest cover applied to 8 or 9 roost sites is less than 1, but conservatively, we estimate that 1 maternity colony would occur in the development footprint. The loss of 2,357–3,316 acres of forest cover is more likely to remove solitary roosts and alternate roosts that individuals who are not part of a harem may use throughout the year.

The Applicants propose to follow the *Consultation Guidelines for the Florida Bonneted Bat*, which the Service has recently updated (USFWS 2019b). These guidelines recommend acoustic surveys, roost surveys, and various avoidance and minimization strategies. Application of these guidelines should avoid killing or injuring FBBs when surveys identify an active roost. However, locating a FBB roost is difficult, and we expect tree removal associated with the development activities to remove some active roosts. Such removal would kill or injure any non-volant pups in the roost and, at minimum, displace any adults present. Pregnant females displaced from an established roost are more likely to fail to reproduce that year, due to the diversion of foraging time to searches for an alternate roost suitable for birthing and rearing a pup.

Bats are vulnerable to predation by diurnal birds (*e.g.,* hawks and falcons). Mikula *et al.* (2016) estimated that the diurnal predation rate on bats is 100–1,000 times higher than the nocturnal predation rate when standardized relative to the duration of day versus night bat activity. The proportion of bats that actually survive fleeing diurnal disturbance at a roost site is undeterminable, but survival is more likely if alternative shelter is available nearby.

Using the average harem size of 1 adult male and 9 adult females (section 4.1.2), we expect that the removal of 1 active maternity roost would, at minimum, displace the adults and kill or injure 9 pups. The predation rate of adult FBBs displaced by roost removal is undeterminable, but we believe most would survive. FBB are likely to occupy areas undergoing development until roosts are removed by construction activity; however, we believe FBBs are more likely to persist long-term in the native habitats of the Preservation and Very Low Density Development areas (see the following sections 4.3.2 and 4.3.3), where forest cover providing potential roosts is more abundant.

The use of pesticides and other chemicals within developed areas could reduce the prey available for bats and sicken or kill any FBBs that consume treated insects. The HCP does not provide information on the types of pesticides and other chemicals planned for use in the Development areas. We expect that mosquito and other chemical pest-control practices would occur with a frequency similar to other towns and cities in the region. Although pesticide use is a plausible threat to FBB in the Plan Area, we are unable to estimate the amount or extent of adverse effects such use may cause.

4.3.2 Preservation Activities

The Preservation areas contain 56.5% of the land cover in the Plan Area (Table 2-2), virtually all of which may support foraging activity for the 148 FBBs we estimate occupy the Plan Area (section 4.2.1). The Preservation areas contains 85% of the forest cover in the Plan Area (Table 4-1), which we expect to support 85% of the roosts (solitary and group) in the Plan Area. We estimate the Plan Area supports 8–9 maternity roosts (section 4.2.1); therefore, the Preservation areas likely contain 6–8 of these.

Covered Activities in the Preservation areas include prescribed burning, mechanical control of groundcover, ditch and canal maintenance, mechanical and chemical control of exotic vegetation, soil tillage, cattle grazing, pesticide and herbicide applications, and other activities that maintain or improve land quality and agricultural uses. Conservation easements placed in these areas as other areas are developed would preclude future commercial and residential development and earth mining, but would allow a continuation of the existing agricultural land uses and other activities listed above.

Fire can have short-term beneficial effects on FBB foraging (Braun de Torrez *et al.* 2018). However, prescribed fire can kill or injure FBB through heat or smoke inhalation, and damage or destroy active and potential roosts. To minimize FBB impacts, the Applicants propose to retain large cavity trees and snags and to implement the Ecological Land Management BMPs of the *Consultation Guidelines for the Florida Bonneted Bat* (USFWS 2019b) in the Preservation areas. These BMPs include buffers for heavy equipment use, guidelines for prescribed fires, and other recommendations for conserving FBB roosting and foraging habitat. If properly applied, the BMPs should avoid, or limit to a discountable probability, FBB death or injury caused by these various land management activities.

Exposure to chemicals (*i.e.,* pesticides, rodenticides, insecticides, fungicides and/or herbicides) associated with agricultural uses could kill or sicken bats. The HCP does not provide specific information regarding the types of chemicals used or the frequency of use. Although pesticide use is a plausible threat to FBB in the Plan Area, we are unable to estimate the amount or extent of adverse effects such use may cause.

We do not expect the management of Preservation areas to reduce the numbers, reproduction, or distribution of the FBB in the Preservation areas, because these activities would, at minimum, maintain current conditions. With the addition of specific actions that benefit the FBB, long-term management of the Preservation areas could increase FBB densities and the Plan Area population. However, lacking more detailed information about FBB in the Plan Area and specific performance measures in the HCP for improving FBB habitat, we are unable to estimate the extent of potential benefits.

4.3.3 Very Low Density Development

The Very Low Density (VLD) use areas contain 1.7% of the land cover in the Plan Area (Table 2-2), virtually all of which may support foraging activity for the estimated 148 FBBs that reside in the Plan Area. The VLD areas contain 2.0% of the forest cover in the Plan Area (Table 4-1), which we expect to support 2% of the roosts (solitary and group) for about 148 FBBs in the Plan Area. We estimate the Plan Area supports 8–9 maternity roosts (section 4.2.2); therefore, it is unlikely that the VLD areas contain a maternity roost.

Land uses in the VLD areas are similar to the Preservation areas, but may also include isolated residences, lodges, and hunting/fishing camps, at a density of no more than one dwelling unit per 50 acres. The Applicants would continue current ranching/livestock operations and other management activities as described for the Preservation areas (*e.g.,* exotic species control, prescribed burning). As in the Preservation areas, we do not expect continuing the existing land management regimes to harm FBBs. The Applicants propose to follow the *Consultation Guidelines for the Florida Bonneted Bat* (USFWS 2019b), which include acoustic and roost surveys and avoidance and minimization strategies.

The HCP does not specify a footprint for the isolated residences, lodges, and hunting/fishing camps, but indicates that their construction could clear up to 10% of the existing native vegetation (see section 2.5). New dwelling development could occur within any of the cover types present besides open water and existing development. It is possible that dwelling development in the VLD areas could entirely avoid forested areas, but we conservatively estimate an 82-acre habitat loss (10% of these types, Table 2-7). We consider the probability that a FBB maternity roost occurs in the footprint of VLD residence development as discountable (the removal of 82 acres from 41,763 forest acres in the Plan Area that support 8–9 maternity roosts). The predation rate of adult FBBs displaced by removal of solitary or non-maternity roosts is undeterminable, but we believe that most would survive. In general, we expect a minor reduction in FBB roosting and foraging habitat in the VLD use area, but no harm that is reasonably certain to occur.

4.3.4 Tables and Figures

Table 4-2. Acreage of FBB roosting habitat within the development envelope of the Plan Area.

COOPERATIVE LAND COVER CLASS (Florida bonneted bat roosting habitat)	DEVELOPMENT	BASE ZONING	ELIGIBLE FOR INCLUSION	Develoment Envelope (Total)	Estimated Extent of Development
Cypress	141	0	1,270	1,411	844
Freshwater Forested Wetlands	110	0	662	772	460
Isolated Freshwater Swamp	168	0	173	341	208
Wet Flatwoods	135	53	20	208	127
Cypress/Tupelo	142	0	262	404	248
Strand Swamp	0	1	14	15	9
Other Hardwood Wetlands	4	0	53	57	34
Dome Swamp	0	37	0	37	22
Hydric Hammock	0	2	0	2	1
Other Coniferous Wetlands	11	0	0	11	6
Mesic Flatwoods	938	0	314	1,252	756
Mixed Hardwood-Coniferous	240	0	165	405	240
Mesic Hammock	417	16	167	601	356
Scrubby Flatwoods	0	0	0	0	0
COLUMN TOTAL	**2,308**	**110**	**3,100**	**5,517**	**3,311**
COLUMN PERCENT	**41.8%**	**2.0%**	**56.2%**		

[1] Prorated acreages according to the "proportional method" taken from column "G"of Table 2-3.

4.4 Cumulative Effects on Florida Bonneted Bat

For purposes of consultation under ESA §7, cumulative effects are those caused by future state, tribal, local, or private actions that are reasonably certain to occur in the Action Area. Future Federal actions that are unrelated to the proposed action are not considered, because they require separate consultation under §7 of the ESA.

We identified in section 3 of this BO/CO a projected increase in traffic on public roads as the sole source of effects that are consistent with the definition of cumulative effects for this Action. FBB generally fly high (>33 feet) above the ground (see section 4.1.2), which minimizes the risk of collisions with vehicles. We have no information that vehicles are a predictable cause of FBB injury, mortality, or significant behavioral modification.

4.5 Conclusion for Florida Bonneted Bat

In this section, we summarize and interpret the findings of the previous sections for the FBB (status, baseline, effects, and cumulative effects) relative to the species-specific purpose of a BO under §7(a)(2) of the ESA, which is to determine whether the proposed action is likely to jeopardize the continued existence of a species.

Status

The FBB is endemic to south and south-central Florida. In areas where the species is detected, abundance is generally low. The species forages in a wide range of habitat types, and roosts in the cavities/crevices of live and dead trees. FBBs also use artificial structures as roosts (*e.g.,* bat houses, buildings). Detection probability is negatively correlated with the local extent of developed (urban) land, but the species does occur in some urban areas. The Service currently estimates range-wide abundance of about 2,000 adults, an extent of occurrence of 3,372 mile^2, and an overall density of about 0.6 FBB per mile^2 (1 adult per 1,079 acres).

The loss of roost sites is the primary known threat to the FBB. Trees with features that provide suitable roosting conditions are limited, and competition with other species for available cavities is likely intense. Accordingly, managing landscapes to supply suitable roosting sites is the species' primary conservation need. In both urban and rural areas, FBB and their insect prey are exposed to various pesticides and contaminants, but the impacts of such exposure are unknown. The species is vulnerable to severe cold weather and storm events and to habitat loss resulting from sea-level rise associated with climate change.

Baseline

All vegetated and open-water land cover classes present in the Plan Area are potential foraging habitats for the FBB, and all forested cover classes, both upland and wetland, are potential roosting habitats. The Plan Area contains 41,763 acres of forested habitat. Acoustic monitoring has detected FBB within and immediately outside of the Plan Area. Documented roosts occur less than 1 mile from the Plan Area. Using the range-wide density of 1 adult FBB per 1,079 acres, we estimate FBB numbers in the Plan Area at about 148 adults. Using the average documented harem size of 1 male and 9 females, we estimate that the Plan Area contains 8–9 maternity colonies.

Threats to the FBB in the Plan Area include habitat loss, especially loss of roosting habitat, roost site competition from native and exotic species, and exposure to pesticides and other contaminants. Managing natural areas to supply suitable roosting sites is the species' primary conservation need in the Plan Area.

Effects

The loss of 2,357–3,311 acres of forest cover from the Development, Base Zoning, and Eligible lands (depending on the actual distribution of the development cap in these land use designations) would reduce the 41,763 acres of forest cover in the Plan Area by 5.6–7.9%. We expect the Plan Area forests to support 8–9 colonial roost sites. The expected loss is less than 1 colonial roost, but conservatively, we estimate that 1 maternity colony would occur in the development footprint. The destruction of 1 active maternity roost would, at minimum, displace 10 adults (average harem size) and kill or injure 9 pups, if present. The predation rate of adult FBBs displaced by roost removal is undeterminable, but we believe most would survive.

We do not expect the management of Preservation and VLD use areas to reduce the numbers, reproduction, or distribution of the FBB in these areas, because these activities would, at minimum, maintain current conditions. The applicants propose to retain large cavity trees and snags in the management of these areas. With the addition of specific actions that benefit the FBB, long-term management of these areas could increase FBB densities and the Plan Area population. We consider the probability that a FBB maternity roost occurs in the footprint of VLD residence development as discountable.

Cumulative Effects

We have no information that suggests collisions with vehicles are a predictable cause of FBB injury, mortality, or significant behavioral modification.

Opinion

The primary impact of the Action to the FBB is the possible removal of a maternity roost during construction activity. We expect this impact to occur only once, affecting the average number of pups and adults in a colony (9 pups and 10 adults). The implementation of the *Consultation Guidelines for the Florida Bonneted Bat* may avoid this impact. The death of all adults in a roost destroyed incidental to construction activities, which is not likely, would represent a 0.5% reduction in the estimated range-wide abundance of about 2,000 adults.

The conversion of land cover that provides foraging areas would add an increment to the overall impact of urbanization in the range of the FBB. The Action's increment of urbanization, 39,973 acres (62.5 $mile^2$) of new development, would represent a 1.9% reduction of the estimated range-wide FBB extent of occurrence (3,372 $mile^2$).

We believe that most FBB individuals present during development activity are likely to survive displacement caused by a gradual loss of habitat in the Development areas, because suitable habitat would remain in the Preservation areas and is available on adjacent conservation lands. Easements in the Preservation areas executed as portions of the Development areas are converted from existing uses would protect both native habitats and agricultural lands from future development. The likely survival of most FBB affected by development activity and the assured continuation of existing habitat conditions in the Preservation areas, which may improve under management and protection, supports an interpretation that the scale of the Action-caused reduction in numbers, reproduction, and distribution we predict does not appreciably reduce species' likelihood of survival and recovery.

After reviewing the current status of the species, the environmental baseline for the Action Area, the effects of the Action and the cumulative effects, it is the Service's biological opinion that the Action is not likely to jeopardize the continued existence of the FBB.

4.6 Status of Florida Bonneted Bat Proposed Critical Habitat

This section summarizes best available data about the current condition of all units of proposed critical habitat (pCH) for the FBB that are relevant to formulating an opinion about the Action.

The Service published its proposal to designate CH for the FBB on June 10, 2020 (85 FR 35510–35544).

4.6.1 Description of Florida Bonneted Bat Critical Habitat Geographic Extent

Proposed CH for FBB is comprised of 1,478,333 acres in 4 separate units located in 10 Counties in Florida (Figure 4-3). A breakdown of units by counties is as follows:

(1) Unit 1: Peace River and surrounding areas (Charlotte, DeSoto, Hardee, and Sarasota Counties);
(2) Unit 2: Babcock-Webb WMA, Babcock Ranch, and surrounding areas (Charlotte, Lee, and Glades Counties);
(3) Unit 3: Big Cypress and surrounding areas (Collier, Monroe, and Hendry Counties); and
(4) Unit 4: Miami-Dade natural areas (Miami-Dade County).

Table 4-3 lists these units and identifies the acreage of each that is under Federal, State, County, or private ownership.

4.6.2 Physical and Biological Features

In this CO for FBB pCH, we use the term physical and biological features (PBFs) to label the key components of pCH that provide for the conservation of the FBB. Our pCH rule identified seven PBFs (85 FR 35510–35544):

(1) Representative forest types (all age classes) that support the Florida bonneted bat by providing roosting and foraging habitat within its core areas (i.e., Polk, Charlotte, Lee, Collier, Monroe, and Miami-Dade Counties), including:
   (a) Pine flatwoods;
   (b) Scrubby pine flatwoods;
   (c) Pine rocklands;
   (d) Royal palm hammocks;
   (e) Mixed or hardwood hammocks;
   (f) Cypress;
   (g) Mixed or hardwood wetlands;
   (h) Mangroves (mature and pristine);
   (i) Cabbage palms; and
   (j) Sand pine scrub.

(2) Habitat that provides for roosting and rearing of offspring; such habitat provides structural features for rest, digestion of food, social interaction, mating, rearing of young, protection from sunlight and adverse weather conditions, and cover to reduce predation risks for adults and young, and includes forest and other areas with tall or mature trees and other natural areas with suitable structures, which are generally characterized by:
   (a) Tall or mature live or dead trees, tree snags, and trees with cavities, hollows, crevices, or loose bark, including, but not limited to, trees greater than 10 m (33 ft) in height, greater than 20 cm (8 in) diameter at breast height, with cavities greater than 5 m (16 ft) high off the ground;

   (b) High incidence of tall or mature live trees with various deformities (e.g., large cavities, hollows, broken tops, loose bark, and other evidence of decay);
   (c) Sufficient open space for Florida bonneted bats to fly; areas may include open or semi-open canopy, canopy gaps and edges, or above the canopy, which provide relatively uncluttered conditions; and/or
   (d) Rock crevices.

(3) Habitat that provides for foraging, which may vary widely across the Florida bonneted bat's range, in accordance with ecological conditions, seasons, and disturbance regimes that influence vegetation structure and prey species distributions. Foraging habitat may be separate and relatively far distances from roosting habitat. Foraging habitat consists of:
   (a) Sources for drinking water and prey, including open fresh water and permanent or seasonal freshwater wetlands, in natural or rural areas (non-urban areas);
   (b) Wetland and upland forests, open freshwater wetlands, and wetland and upland shrub (which provide a prey base and suitable foraging conditions (i.e., open habitat structure));
   (c) Natural or semi-natural habitat patches in urban or residential areas that contribute to prey base and provide suitable foraging conditions (i.e., open habitat structure); and/or
   (d) The presence and abundance of the bat's prey (i.e., large, flying insects), in sufficient quantity, availability, and diversity necessary for reproduction, development, growth, and survival.

(4) A dynamic disturbance regime (natural or artificial) (e.g., fire, hurricanes) that maintains and regenerates forested habitat, including plant communities, open habitat structure, and temporary gaps, which is conducive to promoting a continual supply of roosting sites, prey items, and suitable foraging conditions.

(5) Large patches (more than 40,470 ha (100,000 ac)) of forest and associated natural or semi-natural habitat types that represent functional ecosystems with a reduced influence from humans (i.e., areas that shield the bat from human disturbance, artificial lighting, habitat loss and degradation).

(6) Corridors, consisting of roosting and foraging habitat, that allow for population maintenance and expansion, dispersal, and connectivity among and between geographic areas for natural and adaptive movements, including those necessitated by climate change.

(7) A subtropical climate that provides tolerable conditions for the species, such that normal behavior, successful reproduction, and rearing of offspring are possible.

FBB pCH does not include human-made structures (such as buildings, aqueducts, runways, roads, and other paved areas) and the land on which they are located existing within the legal boundaries.

All pCH units are occupied by the FBB. The Service determined that designating unoccupied units was not essential the conservation of the FBB.

4.6.3 Conservation Value of Florida Bonneted Bat Proposed Critical Habitat

The PBFs of pCH listed in section 4.6.2. address the various aspects habitat that supports the FBB. Not all pCH units contain all seven PBFs. Each pCH unit was selected for its conservation value with respect the PBFs which it does contain.

Unit 1 contains five of the seven PBFs for the bonneted bat (*i.e.,* PBFs 2, 3, 4, 6, and 7). While this unit contains representative forest types that support the species by providing roosting and foraging habitat, it consists of area primarily outside of the bat's core areas (*i.e.,* does not possess all features described in PBF 1). Because of its relatively small size, this unit also does not possess all features described in PBF 5. However, Unit 1 encompasses a known movement corridor (generally connecting individuals between Unit 2 and Avon Park Air Force Range) and adds ecological diversity (a natural river corridor) to the overall proposed designated areas. In addition, the Peace River and adjacent forested lands maintain high habitat suitability, providing open water and likely abundant prey.

Unit 2 represents the westernmost portion of the species' core areas. This unit was occupied at the time of listing, is currently occupied, and contains all seven PBFs for the FBB. Babcock-Webb WMA and surrounding areas support the largest abundance known (approximately 79 bonneted bats), and the bulk of all known roost sites (Myers, pers. comm. 2015; Gore, pers. comm. 2016; Ober, pers. comm. 2014; Braun de Torrez, pers. comm. 2016).

Unit 3 represents the southwestern portion of the species' core areas. The species has been documented to use many locations throughout the unit (specifically, within BCNP, PSSF, FSPSP, and FPNWR) (see table 1 of the final listing rule (78 FR 61004, October 2, 2013)). The discoveries of three natural roosts in 2015 and 2016 further demonstrate the relevance and importance of Unit 3. This unit contains all seven of the PBFs for the FBB.

Unit 4 represents the eastern portion of the species' core areas and includes the bulk of the remaining high-quality natural habitat in the species' former strongholds on the east coast (Belwood 1992, pp. 216–217, 219; Timm and Genoways 2004, p. 857; Timm and Arroyo-Cabrales 2008, p. 1; Solari 2016, pp. 1–2; see *Historical Distribution*, proposed listing rule (77 FR 60750, October 4, 2012)). This area may be the last remaining predominantly natural occupied habitat on the east coast of Florida. This unit contains all seven of the PBFs for the FBB.

4.6.4 Conservation Needs for Florida Bonneted Bat Proposed Critical Habitat

The PBFs essential to the conservation of the Florida bonneted bat in Unit 1 may require special management considerations or protection due to the following: habitat loss, fragmentation, and degradation resulting from development (including oil and gas exploration) and land conversion; impacts from land management practices (e.g., timber management and fuels reduction, prescribed fire, management of nonnative and invasive species, habitat restoration) or lack of suitable habitat management; impacts from climate change and coastal squeeze; and pesticide use.

The PBFs essential to the conservation of the Florida bonneted bat in Unit 2 may require special management considerations or protection due to the following: habitat loss, fragmentation, and degradation resulting from development (including oil and gas exploration) and land conversion; impacts from land management practices (e.g., timber management and fuels reduction, prescribed fire, management of nonnative and invasive species, habitat restoration) or lack of suitable habitat management; impacts from coastal squeeze; and pesticide use.

The PBFs essential to the conservation of the Florida bonneted bat in Unit 3 may require special management considerations or protection due to the following: habitat loss, fragmentation, and degradation resulting from development (including oil and gas exploration) and land conversion; impacts from land management practices (e.g., timber management and fuels reduction, prescribed fire, management of nonnative and invasive species, habitat restoration) or lack of suitable habitat management; impacts from climate change and coastal squeeze; and pesticide use.

The PBFs essential to the conservation of the Florida bonneted bat in Unit 4 may require special management considerations or protection due to the following: habitat loss, fragmentation, and degradation resulting from development and land conversion; impacts from land management practices (e.g., timber management and fuels reduction, prescribed fire, management of nonnative and invasive species, habitat restoration) or lack of suitable habitat management; impacts from climate change and coastal squeeze; and pesticide use.

4.6.5 Tables and Figures

Table 4-3. Florida bonneted bat proposed critical habitat units, including acres by land ownership type, and co-occurring listed species and designated critical habitat found in each unit. Note: WMA = Wildlife Management Area.

Unit	Ownership	Area (acres)
Unit 1—Peace River and surrounding areas		
	State	11,212
	County	295
	Local	32
	Private and Other	34,810
	Unidentified	1,960
	Total	**48,310**
Unit 2—Babcock-Webb WMA, Babcock Ranch, and surrounding areas		
	Federal	3
	State	151,050
	County	9,203
	Local	21
	Private and Other	79,077
	Unidentified	1,587
	Total	**240,941**
Unit 3—Big Cypress and surrounding areas		
	Federal	619,573
	Tribal	26,012
	State	152,882
	County	8,362
	Local	427
	Private and Other	94,460
	Unidentified	4,745
	Total	**906,462**
Unit 4—Miami-Dade natural areas		
	Federal	176,395
	Tribal	805
	State	64,639
	County	10,404
	Local	281
	Private and Other	28,408
	Unidentified	1,688
	Total	**282,620**
	TOTAL	**1,478,333**

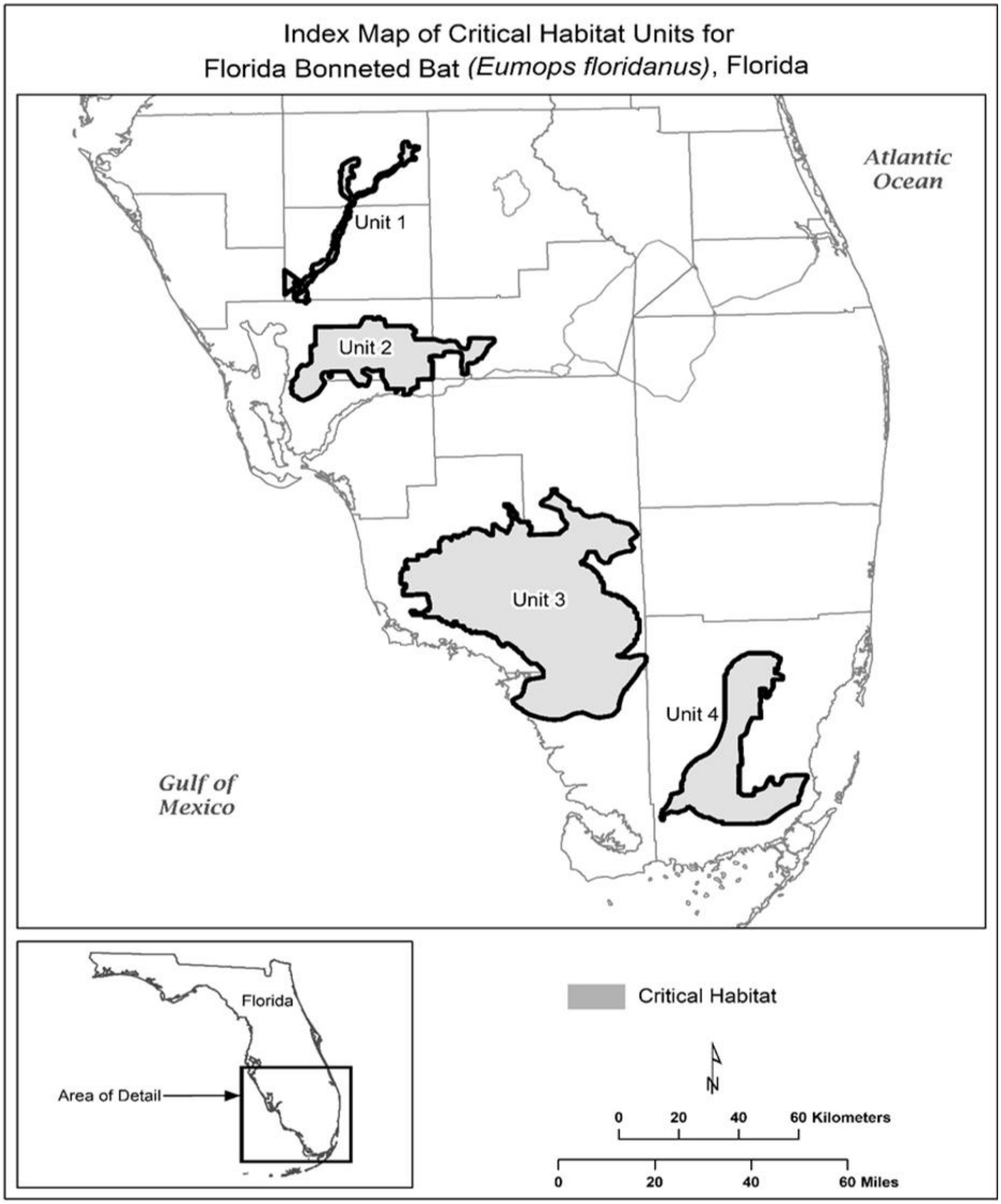


Figure 4-3. Florida bonneted bat proposed critical habitat in central and south Florida. Each proposed critical habitat unit is identified by number from north to south.

4.7 Environmental Baseline for Florida Bonneted Bat Proposed Critical Habitat

This section is an analysis of the effects of past and ongoing human and natural factors leading to the current status of FBB pCH within the Action Area. The environmental baseline is a "snapshot" of the condition of PBFs that are essential to the conservation of the species within the pCH overlapping the Action Area at the time of the consultation, and does not include the effects of the Action under review.

4.7.1 Action Area Conservation Value of Florida Bonneted Bat Proposed Critical Habitat

The Action Area consists of the Plan Area and existing roads surrounding the Plan Area (section 2.1). Because pCH does not include existing roads, the Action Area discussion here will be limited to the Plan Area. The southern portion of the Plan Area, totaling 30,730 acres (Table 4-4), is within pCH Unit 3 (Big Cypress and surrounding areas (Figure 4-4). This portion is 3.4 percent of Unit 3 (906,462 acres).

Proposed CH within the Plan Area consists of 13,206 acres of habitats listed in PBF 1 (Table 4-5). This part of the Plan Area contains 16,641 acres of habitat that could be used for roosting and rearing of offspring (PBF 2) and 30,078 acres of habitat that could be used for foraging (PBF 3) (Table 4-5). This area is subject to dynamic disturbance (BPF 4) in the form of hurricanes and periodic fires. While the portion of Unit 3 within the Plan Area is not greater than 100,000 acres (PBF 5), it is part of a patch larger than 100,000 ac. This portion is also located in the northern part of this pCH unit and serves as a corridor (PBF 6) for FBBs moving from the southern part of this unit to Unit 2 to the north. Lastly, FBB pCH within the Plan Area is located in a subtropical climate (PBF 7).

4.7.2 Action Area Conservation Needs for Florida Bonneted Bat Proposed Critical Habitat

The Plan Area within FBB pCH Unit 3 has the same conservation needs as rest of Unit 3. Namely, special management considerations or protection due to the following: habitat loss, fragmentation, and degradation resulting from development (including oil and gas exploration) and land conversion; impacts from land management practices (e.g., timber management and fuels reduction, prescribed fire, management of nonnative and invasive species, habitat restoration) or lack of suitable habitat management; impacts from climate change and coastal squeeze; and pesticide use.

4.7.3 Tables and Figures

Table 4-4. Habitat types in the Florida bonneted bat proposed critical habitat within the Plan Area of the Eastern Collier Multiple Species Habitat Conservation Plan.

Cooperative Land Cover Type	Covered Activities	Eligible Lands	Preserve	Very Low Density Use	Total
Cropland/Pasture	1,320	128	3,559	0	5,007
Cultural - Lacustrine	0	0	8	447	455
Cultural - Riverine	4	4	33	0	40
Cypress	22	228	6,965	15	7,229
Cypress/Tupelo(incl Cy/Tu mixed)	0	14	1,102	51	1,168
Exotic Plants	0	5	56	0	61
Extractive	0	0	8	44	52
Freshwater Forested Wetlands	0	371	1,521	277	2,169
Freshwater Non-Forested Wetlands	0	0	0	0	0
High Intensity Urban	0	11	0	0	11
Improved Pasture	157	0	1,087	81	1,325
Isolated Freshwater Marsh	0	11	612	0	622
Isolated Freshwater Swamp	0	17	1,244	6	1,267
Lacustrine	0	0	1	0	1
Low Intensity Urban	0	0	18	0	18
Marshes	17	248	2,101	40	2,406
Mesic Flatwoods	30	52	2,140	112	2,334
Mesic Hammock	0	6	105	3	114
Mixed Hardwood-Coniferous	64	0	957	16	1,037
Natural Lakes and Ponds	0	0	5	0	5
Orchards/Groves	0	0	186	0	187
Other Hardwood Wetlands	0	53	421	8	481
Palmetto Prairie	0	0	89	0	90
Prairies and Bogs	18	221	2,541	53	2,833
Rural	18	67	291	123	499
Shrub and Brushland	41	13	257	95	406
Transportation	0	61	7	4	72
Utilities	0	0	0	0	0
Wet Flatwoods	21	11	809	1	842
Total	**1,712**	**1,519**	**26,123**	**1,375**	**30,730**

Table 4-5. The acreage of each land use category of Florida bonneted bat proposed critical habitat within the Eastern Collier Multiple Species Habitat Conservation Plan that contains physical and biological features 1 through 3.

PBF	Development and Mining, Base Zoning, and Lands Eligible for Inclusion	Preserves	Very Low Density Use	Total
1	501	12,078	205	13,206
2	889	15,264	488	16,641
3	3,074	25,799	1,205	30,078

Figure 4-4. Florida bonneted bat proposed critical habitat (pCH) overlaid on the Plan Area of the Eastern Collier Multiple Species Habitat Conservation Plan in Collier County, Florida. A portion of the Plan Area is within pCH Unit 3.

4.8 Effects of the Action on Florida Bonneted Bat Proposed Critical Habitat

This section analyzes the direct and indirect effects of the Action on pCH for the FBB. Direct effects are caused by the Action and occur at the same time and place. Indirect effects are caused by the Action, but are later in time and reasonably certain to occur. Our analyses are organized according to the land-use designations of the HCP found in the description of the Action in section 2 of this BO/CO.

4.8.1 Development and Mining, Base Zoning, and Lands Eligible for Inclusion

The Development and Mining, Base Zoning, and Lands Eligible for Inclusion (lands that make up the Development Envelope) within FBB pCH Unit 3 contain 501 acres of habitats that are listed in PBF 1 (Table 4-5). This acreage is 3.8 percent of PBF1 habitats within the Plan Area portion of Unit 3. These same Development Envelope lands contain 889 acres (6.7 percent) of habitats that support PBF 2 (habitat that provides for roosting and rearing of offspring). Finally, there are 3,074 acres (10.2 percent) of habitat that support PBF 3 (Habitat that provides for foraging) in the Development Envelope within Unit 3.

Lands in the Development Envelope within Unit 3 will likely be developed because development proposals have already been submitted for the areas in the southwest portion of the Plan Area which is most of the Development Envelope lands in Unit 3. Once developed, they will lose these PBFs 1 through 3. They will also lose some of PBF 4 (dynamic disturbance) except for hurricanes. They will no longer be part of a large patch of forested or natural habitat (PBF 5) and they will no longer have the characteristics of PBF 6 (corridors). PBF 7 (subtropical climate) will remain.

Given that the Development Envelope FBB pCH habitats make up at most 10 percent (PBF 3) of Plan Area lands in Unit 3, and that Plan Area lands in Unit 3 make up 3 percent of Unit 3, it is unlikely that development of these lands will significantly alter the PBFs of Unit 3.

4.8.2 Preservation Activities

The Preservation Areas within FBB pCH Unit 3 contain 12,078 acres of habitats that are listed in PBF 1 (Table 4-5). This acreage is 91.4 percent of PBF1 habitats within the Plan Area portion of Unit 3. These Preservation Areas contain 15,264 acres (91.7 percent) of habitats that support PBF 2 (habitat that provides for roosting and rearing of offspring). Finally, there are 25,799 acres (85.8 percent) of habitat that support PBF 3 (Habitat that provides for foraging) in the Preservation Areas within Unit 3.

The Preservation Areas will be maintained in their current state which is mostly native habitats and some agriculture within Unit 3. Landowners will continue to manage this land as they always have. Therefore, we expect the Preservation Areas to maintain PBFs 1-4. The Preservation Areas within Unit 3 maintain connectivity to large acreages of Unit 3 to the south and outside of the Plan Area, preserving PBF 5. The HCP includes permanent protection of two north/south wildlife linkages that begin in the pCH and extend to the north outside of the pCH. These linkages preserve connectivity (PBF 6) for FBBs to move north toward Unit 2. PBF 7 (subtropical climate) also will remain. Preservation Areas may be restored or enhanced which would improve PBFs 1 through 6.

Because the Preserve Areas are expected to be maintained or improved, and they make up from 86 percent (PBF 3) to 91 percent (PBFs 1 and 2) of the habitats supporting PBFs in the Plan Area portion of Unit 3, we expect activities in the Preserve Areas of Unit 3 will maintain or possibly improve the PBFs of Unit 3.

4.8.3 Very Low Density Development

The VLD Areas within FBB pCH Unit 3 contain 205 acres of habitats that are listed in PBF 1 (Table 4-5). This acreage is 1.6 percent of PBF1 habitats within the Plan Area portion of Unit 3. These VLD Areas contain 488 acres (2.9 percent) of habitats that support PBF 2 (habitat that provides for roosting and rearing of offspring). Finally, there are 1,205 acres (4.0 percent) of habitat that support PBF 3 (Habitat that provides for foraging) in the Preservation Areas within Unit 3.

The VLD Areas will be developed at a ratio of 5 acres per 50 acres (10 percent). If this 10 percent of development of VLD all occurred in habitats supporting PBFs, then 20.5 acres (0.2 percent) of habitats listed for PBF 1 would be lost, 48.8 acres (0.3 percent) of habitats supporting PBF 2 would be lost and 120.5 acres (0.4 percent) of habitats supporting PBF 3 would be lost. The undeveloped acreage is expected to be maintained as it has been in the past and therefore maintain PBFs 1 through 3 in these areas. Therefore, dynamic disturbance (PBF 4) is expected to continue in the remaining acreage. The small and scattered acreages expected to be developed in the VLD Areas are not expected to disconnect these areas from the larger habitat blocks (PBF 5), nor are they expected to significantly reduce the connectivity (PBF 6) of the VLD Area. PBF 7 (subtropical climate) also will remain.

Since the VLD Areas have a very small percent (up to 0.4 percent for PBF 3) of habitats supporting PBFs in the Plan Area of Unit 3, the remainder of the VLD lands are expected to retain many PBFs, and the Plan Area lands in Unit 3 make up 3 percent of Unit 3, we expect the development of the VLD areas to have an insignificant effect on the PBFs of Unit 3.

4.8.4 Summary

The loss of habitats supporting PBFs of FBB pCH in Unit 3 is expected to be 889 acres in the Development Envelope and 120.5 in the VLD Areas, or a total of 1,009.5 acres. This is 0.1 percent of Unit 3. Undeveloped portions of VLD Areas are expected to retain most of their PBFs and, Preserve areas may be restored or enhance which could improve the PBFs.

4.9 Cumulative Effects

As discussed in section 4.7.1, the only part of the Action Area that contains FBB pCH is the Plan Area. We are unaware of other non-federal actions in the Plan Area that are reasonably certain to occur and that may affect the FBB pCH. Therefore, there are no cumulative effects related to FBB pCH.

4.10 Conclusion for the Florida Bonneted Bat Proposed Critical Habitat

In this section, we summarize and interpret the findings of the previous sections for FBB pCH (status, baseline, effects, and cumulative effects) relative to the purpose of a CO under §7(a)(2) of the ESA, which is to determine whether a Federal action is likely to:

a) jeopardize the continued existence of species listed as endangered or threatened; or
b) result in the destruction or adverse modification of designated CH.

"*Destruction or adverse modification*" means a direct or indirect alteration that appreciably diminishes the value of pCH for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the PBFs essential to the conservation of a species or that preclude or significantly delay development of such features (50 CFR §402.02).

<u>Status</u>

Proposed CH for the FBB is comprised of 1,478,333 acres in 4 units located in 10 counties in central and southern Florida. Seven PBFs have been proposed that relate to habitats necessary for FBBs to roost, rear offspring, and forage; and to conditions needed to maintain these habitats and FBB populations (disturbance, large patches of habitat, corridors, and subtropical climate).

<u>Baseline</u>

The acreage of the Action Area within pCH Unit 3 is 30,730 acres, and its percent of Unit 3 is small (3.4 percent). This area does include all seven PBFs and consists mostly of native habitats. Unit 3 is 906,462 acres.

<u>Effects</u>

Development within the Development Envelope located in Unit 3 will cause the loss of up to 889 acres that support PBFs. The Development Envelope FBB pCH habitats make up at most 10 percent (PBF 3) of Plan Area lands in Unit 3, and the Plan Area lands in Unit 3 make up 3 percent of Unit 3. Considering these factors, it is unlikely that development of these lands will significantly alter the PBFs of Unit 3.

The Preserve Areas are made up of 25,799 acres of habitats supporting Unit 3 PBFs. Because the Preserve Areas are expected to be maintained or improved, and they make up from 86 percent (PBF 3) to 91 percent (PBFs 1 and 2) of the habitats supporting PBFs in the Plan Area portion of Unit 3, we expect activities in the Preserve Areas of Unit 3 will maintain or possibly improve the PBFs of Unit 3.

Up to 120.5 acres of land supporting PBFs within the VLD Areas could be lost to development. Since the development expected within the VLD Areas would cause the loss of a very small percent (up to 0.4 percent for PBF 3) of habitats supporting PBFs in the Plan Area of Unit 3, the remaining VLD lands are likely to retain many PBFs, and the Plan Area lands in Unit 3 make up

3 percent of Unit 3, we expect the development of the VLD areas to have an insignificant effect on the PBFs of Unit 3.

Cumulative Effects

We are unaware of other non-federal actions in the Action Area that are reasonably certain to occur and that may affect the FBB pCH.

Opinion

Although the Action would reduce the acreage that can support the PBFs of FBB pCH in Unit 3 by about 0.1 percent, we believe the action would not significantly decrease the PBFs within Unit 3. The PBFs may be improved if Preserve Areas are restored or enhanced.

After reviewing the current status of the pCH, the environmental baseline for the Action Area, the effects of the Action, and the cumulative effects, it is the Service's conference opinion that the Action is not likely to destroy or adversely modify pCH for the FBB.

5 Florida Panther

This section provides the Service's biological opinion of the Action for the Florida Panther.

5.1 Status of Florida Panther

This section summarizes best available data about the biology and current condition of the Florida panther (*Puma concolor coryi*) (panther) throughout its range that are relevant to formulating an opinion about the Action. The Service published its decision to list the panther as endangered on March 11, 1967 (32 FR 4001). In addition, the Florida Panther Act (Florida Statute 372.671), a 1978 Florida State law, made killing a panther a felony. The panther is listed as endangered by the States of Florida, Georgia, Louisiana, and Mississippi in addition to its Federal listing. Critical habitat has not been designated for the panther.

The following Service documents, cited in this section as necessary, provide additional details about the status of the panther:

- Florida Panther Recovery Plan (3rd Edition, 2008)
- Annual Report on the Research and Management of Florida Panthers: 2018–2019 (FWC 2019)
- Species Status Assessment for the Florida Panther (USFWS Draft 2020)

5.1.1 Species Description

An adult panther is unspotted and typically rusty reddish-brown on the back, tawny on the sides, and pale gray underneath. Adult males can reach a length of 7 feet (ft) (2.1 meters [m]) from their nose to the tip of their tail and may exceed 161 pounds (lbs) (73 kilograms [kg]) in weight; but, typically adult males average around 116 lbs (52.6 kg) and stand about 24 to 28 inches (in) (60 to 70 centimeters [cm]) at the shoulder (Roelke 1990). Female panthers are smaller with an average weight of 75 lbs (34 kg) and length of 6 ft (1.8 m) (Roelke 1990). Panther kittens are gray with dark brown or blackish spots and five bands around the tail. The spots gradually fade as the kittens grow older and are almost unnoticeable when 6 months old. At this age, their bright blue eyes slowly turn to the light-brown straw color of the adult (Belden 1988).

5.1.2 Life History

Panthers require large areas to meet their needs. Mean home range size of females >24 months-of-age between 2004 and 2018 was 217.04 km^2 (48.38–765.35 km^2; $n = 43$). Mean home range size of adult males >36 months-of-age during the same time period was 428.35 km^2 (91.16–1987.60 km^2; $n = 34$). Adult female puma home ranges in western North America vary from about 55 km^2 to over 300 km^2 (Pierce and Bleich 2003, Logan and Sweanor 2010). Male puma home ranges in western North America are typically 1.5–3 times the size of female home ranges at 150 km^2 to 700 km^2 (Pierce and Bleich 2003, Logan and Sweanor 2010). Numerous factors influence panther home range size including habitat quality, prey density, interrelationships with other panthers, and landscape configuration (Belden 1988, Comiskey et al. 2002, Sunquist and Sunquist 2002, Logan and Sweanor 2010). All these factors can fluctuate over time and can change panther densities across the landscape. In turn, these fluctuations make it difficult to determine the amount of habitat necessary to sustain the panther population.

Male panthers are polygynous, maintaining large, overlapping home ranges containing several adult females and their dependent offspring. Breeding activity peaks from December to March (Shindle et al. 2003). Litters ($n = 82$) are produced throughout the year, with 56 to 60 percent of births occurring between March and June (Jansen et al. 2005; Lotz et al. 2005). The greatest number of births occurs in May and June (Jansen et al. 2005; Lotz et al. 2005). Average litter size is 2.4 ± 0.91 (standard deviation) kittens. Seventy percent of litters are comprised of either two or three kittens.

Panther dens are usually located closer to upland hardwoods, pinelands, and mixed wet forests and farther from freshwater marsh-wet prairie (Benson et al. 2008). Most den sites are in dense saw palmetto (*Serenoa repens*), shrubs, or vines (Maehr 1990a; Shindle et al. 2003, Benson et al. 2008). Den sites are used for 6 to 8 weeks by female panthers and their litters from birth to weaning (Benson et al. 2008). Independence and dispersal of young typically occurs at 14 months, but may occur as early as 9 months (Maehr et al. 2002).

Adult females and their kittens interact more frequently than any other group of panthers. Interactions between adult male and female panthers last from 1 to 7 days and usually result in pregnancy (Maehr et al. 1991). Aggressive interactions between males often result in serious injury or death. Independent subadult males have been known to associate with each other for several days and these interactions do not appear to be aggressive in nature. Based on radio-collared panthers, aggression between males is the most common cause of male mortality (FWC 2014) and an important determinant of male spatial and recruitment patterns (Maehr et al. 1991; Shindle et al. 2003).

Dispersal is the movement an animal makes from its birthplace to where it reproduces or would have reproduced if it had survived (Howard 1960). Dispersal is an important driver of Florida panther range expansion into otherwise suitable, but presently unoccupied habitats in its former range and gene flow within the range. It is an important mechanism by which recovery of the species can be achieved through natural population growth over time.   Panther dispersal begins after a juvenile becomes independent from its mother and continues until it establishes a home range. Dispersal distances are greater for males than females (Maehr et al. 2002). The maximum dispersal distance recorded for a young male was 500 miles (805 km; FWC 2009). Maehr et al. (2002) found males disperse an average distance of 42.5 miles (68.4 km) and females typically remain in or disperse short distances from their natal ranges. Female dispersers establish home ranges less than one average home range width from their natal range (Maehr et al. 2002a). Maehr et al. (2002a) reported all female dispersers (n = 9) were successful at establishing a home range whereas only 63 percent of males (n = 18) were successful. Dispersing males usually go through a period as transient (non-resident) subadults, moving through the fringes of the resident population and often occupying suboptimal habitat until an established range becomes vacant (Maehr 1997).

Female use areas smaller areas and males compete for access to as many females as possible by establishing home ranges that intersect with those of numerous females. Subordinate males are excluded from breeding in natal areas so dispersal may help increase their mating probability (Greenwood 1980). A large proportion of males can be denied access to females and it is this competition that leads to male dispersal. Because of competition for home ranges and exclusion from mating in natal ranges young male panthers often use unfavorable habitats, such as highly urbanized areas. As the panther population has grown since 1995 more panthers have appeared in such areas (Interagency Florida Panther Response Team 2014, Interagency Florida Panther Response Team 2015).

Panther dispersal is constrained geographically by human activities, fragmented habitat, and the fact that the population exists on a peninsula. Major urban areas are found on both the Atlantic and Gulf coasts restricting the current breeding population of panthers to the southern interior of the peninsula. Additionally, it is likely that the small size of the panther population in early years of the recovery effort, combined with the philopatric behavior of females slowed range expansion into unoccupied suitable habitat. As the panther population increased in size following genetic introgression in 1995, females were increasingly found further from the core population. By 2000, female panthers were present and breeding on Okaloacoochee Slough State Forest (OSSF) (FWC 2001). In 2012, a female was documented with kittens just south of the Caloosahatchee River, about 15 km north of OSSF (FWC unpublished data). It took about 20 years for dispersing females to repopulate areas 40 km north of core population, and over 40 years for female panthers to expand to areas north of the Caloosahatchee River, approximately 60 km north of the core population.

During dispersal and other reasons for movement, Florida panthers exhibit three states of movement based on an analysis of 10 males and 3 females monitored with GPS-telemetry between 2005 and 2012: 1) resting 2) moderately active; and 3) traveling (van de Kerk et al. 2015). Resting is characterized by very short step lengths (i.e., distance between subsequent hourly GPS locations) and near-uniform turning angles. Panthers of both sexes spend the majority of the day resting. Moderately active movement is characterized by long step lengths but more variable turning angles. Moderately active movement usually occurs during intrapatch movements or when searching for prey. This, movement tends to be slower and lacks directionality. Traveling is characterized by long step lengths and a near-straight-line movement pattern, indicating persistent directional movement. Traveling generally takes place while individuals move between habitat patches and patrol home ranges or territories (van de Kerk et al. 2015).

Male Florida panthers have longer daily movement distances than females (van de Kerk et al. 2015, Criffield et al. 2018). Movement patterns of panthers are generally constrained within home ranges except when dispersing (van de Kerk et al. 2015). Young, dispersing males have longer average step lengths than resident males, possibly because dispersers must traverse longer distances in the search for available territories. Telemetry data indicate that panthers typically do not return to the same resting site day after day, except for females with dens or panthers remaining near kill sites for several days (USFWS 2008).

Activity levels for Florida panthers are greatest at night with peaks around sunrise and after sunset (Maehr et al. 1990b, USFWS 2008, Onorato et al. 2011, Criffield et al. 2018). Panthers primarily rest during the day and travel during the night (van de Kerk et al. 2015). The presence of physical evidence such as tracks, scats, and urine markers, confirms panthers move extensively within home ranges, visiting all parts of the range regularly while hunting, breeding, and other activities (Maehr 1997; Comiskey et al. 2002). Males travel widely throughout their home ranges to maintain exclusive breeding rights to females. Females without kittens also move extensively within their ranges (Maehr 1997). Panthers can move large distances in short periods of time. Nightly panther movements of 12 mi (20 km) are not uncommon (Maehr et al. 1990a).

During movement panthers select forested habitats either within their home range or within a study area (Belden et al. 1988, Cox et al. 2006, Kautz et al. 2006, Land et al. 2008, Onorato et al. 2011), especially during the day. At night panthers prefer to move along the forest edges, which they use as stalking cover to ambush white-tailed deer or feral hogs feeding in open areas. Once locating prey panthers often move into open areas to make the kill, and then drag the prey into forest cover to feed (Onorato et al. 2011). Panther movement into and use of open habitats is greater during nighttime than during daytime (Onorato et al. 2011).

Seasonal rainfall patterns have a strong influence of Florida panther movements (Criffield et al. 2018). South Florida is characterized by a tropical climate, a topographically flat landscape that includes permanent and ephemeral wetlands, and abundant rainfall during the hotter summer months (May–October) followed by relatively dry cooler winters (October–May). Both sexes travel faster and farther during the dry season than the wet season (van de Kerk et al. 2015, Criffield et al. 2018). Males cover approximately 26 percent of their home range each week in the winter dry season compared to approximately 11 percent of their home range in the summer wet season. Females cover approximately 12 percent of their home range in the dry season compared to 4 percent in the wet season.

Movements of females are dictated by their reproductive chronology and are influenced by the presence of young (Criffield et al. 2018). Pregnant females establish a den within their home range just prior to giving birth. When caring for kittens, this female spent 22 percent more time in resting mode than when she was without kittens. Florida panther kittens generally stay in their natal dens for the first 8 weeks of their lives, during which time movements of their mothers are restricted to areas close to the den. Kittens older than about 8 weeks can follow their mothers, but their limited mobility may constrain movement speed of their mothers, leading to shorter average step lengths. Movements become progressively longer until young disperse at approximately 14 months-of-age (Maehr et al. 2002*b*). Following dispersal of the young, females typically have a short period of less-constrained movement until they mate again and the cycle repeats (Criffield et al. 2018). Adult males often have been observed in close proximity to females within 2 weeks of the dispersal of juveniles (Maehr et al. 2002*b*).

Panthers are unique among *Puma concolor* in that they will readily consume a wider variety of prey, and greater abundance of prey of low individual weight relative to other populations of *Puma concolor* studied in western North America, Central America, and South America (Iriarte et al. 1990). Maehr et al. (1990b) found prey consumed by panthers and their proportion of occurrence in panther diets were: feral hog (*Sus scrofa*), 42 percent; white-tailed deer (*Odocoileus virginianus*), 28 percent; raccoon (*Procyon lotor*), 12 percent; nine-banded armadillos (*Dasypus novemcinctus*), 8 percent; marsh rabbit (*Sylvilagus palustris*); 4 percent; and domestic livestock (*Bos taurus taurus* and *Equus ferus caballus*), 2 percent. The remaining 4 percent of prey detected by Maehr et al. (1990b) included: cotton rat (*Sigmodon hispidus*); panther; opossum (*Didelphis virginianus*);rice rat (*Oryzomys palustris*);black bear (*Ursus americana*); an unknown Mustelidae (likely a river otter, *Lontra canadensis*); an unknown bird; an alligator (*Alligator mississippiensis*); an unknown lizard; and an unknown mammal.

Maehr et al. (1990b) also found panthers varied their diet from one area to another. For instance, north of 26°11’ N latitude, (coinciding with I-75 and a steep transition in soil hydrology and chemistry), 85.7 percent of prey occurrence in panther diets was white-tailed deer and feral hog. South of I-75, these only made up 66.1 percent of prey consumed by panthers. Panthers also consumed more raccoons in the north than the south (19 percent versus 3 percent, respectively). Caudill et al. (2019) found the proportion of wild hog and white-tailed deer was equal north and south of the interstate (45.6 percent and 40.5 percent, respectively) but the relative abundance of each was inverse, with panthers consuming more wild hog in the north and more white-tailed deer in the south. In the Everglades, Dalrymple and Bass (1996) found 61.1 percent of prey consumed by panthers were white-tailed deer and feral hog, 11.1 percent were American alligator, and 16.7 percent were raccoons. The remainder in all cases included armadillo, rabbit, rodents, livestock, and other predators like bobcats, black bears, other panthers, and coyotes in trace amounts. All livestock consumed were north of I-75 (Table 5-1).

Panthers also change their food habits over time. Analyzing stomach content, scat, and feces samples collected from 1989 to 2014 across the range of the species, Caudill et al. (2019) found raccoon occurrence in panther diets increased after 1995, while wild hog occurrence decreased, and white-tailed deer occurrence appeared constant. Caudill et al. (2019) also found that food habits varied by region, and these too had changed over time. After genetic restoration (1996–

2014) panthers generally north of I-75/Alligator Alley consumed more wild hog, while those south of this boundary consumed more white-tailed deer (Table 5-1).

Little information on the feeding frequency of the panther is available. However, the feeding frequency of the western *Puma concolor* is likely similar to the feeding frequency of the Florida panther. Ackerman et al. (1986) reported a resident adult male puma generally consumes one deer-sized prey every 8 to 11 days. Moreover, a resident female puma will consume one deer-sized prey item every 14 to 17 days, and one deer-sized prey item every 3.3 days for a female with three 13-month-old kittens. A comparison of the results obtained by Maehr et al. (1990b) and Caudill et al. (2019) finds overall biomass consumed by panthers has declined across their range as population size increased (Table 5-2).

Panthers can live up to 20 years in the wild, but the mean age at death for panthers radio-collared at ≥1 year-of-age are 7.7 years and 5.5 years for females (n = 68) and males (n = 91), respectively (FWC unpublished data). Survival rates are higher for females than for males with subadult females exhibiting the highest annual survival (Benson et al. 2009). These estimates follow the same pattern as other *Puma* studies with average annual female and male survival rates of 0.798 and 0.691, respectfully (female range: 0.586 – 0.86; male range: 0.33 – 0.91), across 8 different studies (Logan and Sweanor 2010, Lambert et al. 2006, Laundré et al. 2007, Clark et al. 2014, Robinson et al. 2014, Vickers et al. 2015).

5.1.3 Habitat

Our Florida Panther Recovery Plan and Species Status Assessment for the Florida Panther provide a description of Panther habitat characteristics, from which we summarize information that is relevant to this consultation here. Radio-collar data and ground tracking indicate that panthers use the mosaic of habitats available to them as resting and denning sites, hunting grounds, and travel routes. The majority of telemetry locations and natal den sites occur within, or very close to, forested cover types. These include cypress swamp, pinelands, hardwood swamp, and upland hardwood forests (Belden 1986; Belden et al. 1988; Maehr 1990c; Maehr et al. 1991; Maehr 1992; Smith and Bass 1994; Kerkhoff et al. 2000; Comiskey et al. 2002, Cox et al. 2006, Kautz et al. 2006, Land et al. 2008; Benson et al. 2008). Analysis of Global Positioning System (GPS) tracking data likewise finds panthers (n = 12) primarily forested habitat types, then all other habitat types in proportion to availability (Land et al. 2008). Onorato et al. (2010) provided further analysis of this data set and found panthers selected upland forest, wetland forest, marsh-shrub-swamp, and prairie-grassland habitats, and use agriculture and “other” habitat types relative to their availability and their proximity to a forest patch. Our own analysis of all records (Radio telemetry, GPS tracking, locations of panther-vehicle collisions, locations of confirmed depredation events, confirmed den locations, and confirmed observations) found 95.7 percent of all panther records occur within a forest habitat type or within another habitat type within 984 ft (300 m) of forest cover.

Kautz et al. (2006) found forest structure is also important to panthers. Specifically, panthers prefer smaller forest patches in their home ranges (*i.e.*, 9 to 26 ac [3.6 to 10.4 ha]). This is likely because small forest patches have a higher edge-to-area ratio, making them most suitable for panthers stalking and ambushing prey (Belden et al. 1988; Cox et al. 2006, Frakes et al. 2015).

Panthers mostly use those with dense understory vegetation comprised of saw palmetto for resting and denning (Maehr 1990a; Benson et al. 2008). On a landscape scale Frakes et al. (2015) found low human population density, high abundance of forest edge, low dry season water depth, and low wet season water depth also strongly predict panther presence.

Based on their South Florida Random Forest Panther (RFP) model, Frakes et al. (2015) estimated 5,579 km^2 of habitat remain available to panthers south of the Caloosahatchee River. However, a shortcoming of the RFP model (Frakes et al. 2015) is that it did not use the full record of panther occurrence and instead relied exclusively on telemetry data to construct their model. To address this shortcoming the Service and FWC include additional GPS and telemetry data, vehicle mortality locations, depredation locations, and confirmed sightings in conjunction with the RFP modeling technique to delineate a more inclusive area of occupancy. The Service defines these two areas as Zones A and B (Figure 5-1). Zone A covers 6,103 km^2 and is largely coincident with the areas of suitable habitat identified by the South Florida RFP model (Frakes et al. 2015) with a probability of presence ≥ 0.30 and an average 0.667 probability of presence [on a scale of 0 (low) to 1 (high)]. Approximately 4,357 km^2 (71 percent) of Zone A is within existing conservation lands. Zone A is known to support breeding female panthers and encompasses much of the original Primary Zone based on Kautz et al. (2006). Zone B, which covers 2,991 km^2, is comprised of generally lower quality habitat that nevertheless provides connectivity between habitats in Zone A. This zone is used by dispersing panthers, and occasionally supports breeding females, but with substantially less frequency than Zone A. Zone B consists of panther habitat with a probability of presence ranging from 0.1 to 0.29 and an average 0.158 probability of presence. Approximately 1,339 km^2 (45 percent) of Zone B is within existing conservation lands. Zone B encompasses much of the original Secondary Zone based on Kautz et al. (2006). The combined area of Zones A and B is defined by the Service as the "Functional Zone," and its extent encompasses approximately 9,094 km^2 (USFWS Draft 2020). These zones comprise areas of suitable habitat identified by the South Florida RFP model (Frakes et al. 2015) and additional areas of habitat known to support panthers based on existing occurrence data. In all, approximately 5,696 km^2 (63 percent) of the Functional Zone is protected by existing conservation lands and this Functional Zone remains the only area known to support a population of panthers (Frakes and Knight in preparation; Hostetler et al. 2013; Frakes et al. 2015; van de Kerk et al. 2019, USFWS Draft 2020).

5.1.4 Travel and Dispersal Corridors

As discussed in 5.1.2. panther dispersal is constrained geographically by human activities, fragmented habitat, and the fact that the population exists on a peninsula. Maintaining a permeable, connected landscape for panthers requires dispersal corridors that meet their needs and is essential for the conservation of panthers. In the absence of direct field observations/measurements, Harrison (1992) suggested landscape corridors for wide-ranging predators should be half the width of an average home range size. Following Harrison's (1992) suggestion, corridor widths for panthers would range from 6.1 to 10.9 mi (9.8 to17.6 km) depending on whether the target animal was an adult female or a transient male. Beier (1995) suggested that corridor widths for transient male puma in California could be as small as 30 percent of the average home range size of an adult panther; however, topography in California is dramatically different from that in Florida. Without supporting empirical evidence, Noss (1992) suggests regional corridors connecting larger hubs of habitat should be at least 1.0 mi (1.6 km) wide. Beier (1993,1995) makes specific recommendations for very narrow minimum corridor widths based on short corridor lengths in a California setting of wild lands completely surrounded by urban areas; he recommended corridors with a length less than 0.5 mi (0.8 km) should be more than 328 ft (100 m) wide, and corridors extending 0.6 to 4 mi (1 to 7 km) should be more than 1,312 ft (400 m) wide.

An earlier effort to map areas of South Florida important for panther habitat conservation resulted in three distinct regions of panther habitat (Kautz et al. 2006): Primary Zone, Secondary Zone, and Dispersal Zone. The Dispersal Zone was defined as a small wildlife corridor east of LaBelle, Florida, intended for protection to facilitate long-term movements of panthers out of South Florida and into potentially suitable habitats in Central Florida north of the Caloosahatchee River. The Dispersal Zone encompasses 44 mi^2 (113 km^2) with a mean width of 3.4 mi (5.4 km) (Figure 5-2). Although it is not large enough to encompass an entire panther home range, the Dispersal Zone is strategically located and expected to function as an important landscape linkage to south-central Florida (Kautz et al. 2006). Panthers currently use this zone as they disperse northward into south-central Florida. Part of at least one female panther home range has been documented inside the dispersal zone, and female panthers recently documented north of the Caloosahatchee River are presumed to have used the Dispersal Zone in their northward expansion.

5.1.5 Numbers, Reproduction, and Distribution

Historically occurring throughout the southeastern United States (Young and Goldman 1946), today the panther is restricted to less than 5 percent of its historical range. Currently, the only breeding population is south of the Caloosahatchee River in south Florida. Female panthers have been documented in eight Florida counties since 1973 (USFWS 2020). From 1980 through October 2016, all occurrence data indicated that female panthers were present only south of the Caloosahatchee River and most reproduction occurred in Collier, Hendry, Lee, and Miami-Dade counties (USFWS 2020). In November 2016, an adult female panther was documented on the Babcock Ranch Preserve in Charlotte County (FWC 2017), the first time since 1973 that a female panther has been confirmed north of the Caloosahatchee River (USFWS 2020). A minimum of three adult female panthers and at least four litters of kittens have been documented north of the Caloosahatchee River between November 2016 and June 2020 (Kelly and Onorato 2020, USFWS 2020). As of June 2020, there is no evidence that successful recruitment, i.e., offspring born and surviving to enter the breeding population as adults, has occurred north of the Caloosahatchee River (Kelly and Onorato 2020), and until that evidence is documented, we do not conclude that the breeding range of Florida panthers has expanded beyond South Florida (USFWS 2020).

Since its listing the panther population has increased from an estimated 12-20 adults in the early 1970s to an estimated 120-230 adults in 2015 (Figure 5-3; FWC and Service 2017, USFWS Draft 2020). The lower bound is based on the number of adults and subadults documented during the most recent annual minimum count (2015). The upper bound of 230 is calculated using annual count data from core (very good) panther habitat to derive a density of panthers for that area. The density value is then multiplied by the total number of acres of habitat in the primary zone as identified by Kautz et al. (2006) to come up with an upper range of 230. Because this method does not account for sampling effort, imperfect detection of animals, or provide a margin of error, it can't be categorized as a scientific population estimate. Even with these shortcomings, this methodology has provided agencies with a reliable means of monitoring the population with the best data currently available (FWC and Service 2017).

Estimating the number of panthers on local scales often requires the use of density estimates in available habitat. Most estimates of puma density in western North America have been in the range of 0.3 to 3.6 individuals per 100 km^2 (Pierce and Bleich 2003, Quigley and Hornocker 2010). However, recent studies employing new methodologies have reported puma densities in the range of 3.7 to 6.7 individuals per 100 km^2 in areas of northeast Oregon and the Rocky Mountains in western Montana, and estimates as high as 7.1 and 7.3/100 km^2 have been reported for Vancouver Island and Texas, respectively (Pierce and Bleich 2003, Quigley and Hornocker 2010, Russell et al. 2012, Davidson et al. 2014).

Maehr et al. (1991) provided the earliest estimate of panther population density at 0.91/100 km^2 at a time when the number of panthers was thought to be 30–50 animals. This estimate was based on counting marked (radiocollared) and unmarked panthers in a given area. This technique has been described as the "gold standard" for estimating puma density even though it lacks a measure of variance and is in fact, nothing more than a simple count (Cougar Management Working Group 2005). Twenty years later, and following genetic restoration, new techniques have been developed that utilize a CMR framework on data collected from camera trap grids. These spatial mark-resight (SMR) models account for detection probabilities and effort, and provide measures of uncertainty associated with estimates. Sollmann et al. (2013) used an SMR model to estimate panther density in the Picayune Strand Restoration Project area at 1.5/100 km^2. Similar SMR models were later applied to data generated from camera trap grids on three 225-km^2 study areas that included public and private land in South Florida (Dorazio and Onorato 2018, Onorato et al. 2020). Panther density in the Addition Lands of Big Cypress National Preserve (BCNP) was estimated at 1.37/100 km^2 in 2014. Panther density in a study area that included FPNWR and adjoining areas of Picayune Strand State Forest (PSSF) and Fakahatchee Strand Preserve State Park (FSPSP) was estimated 4.03/100 km^2 in 2014. Panther density in the Immokalee Ranch (IMR) study area was estimated at 3.90/100 km^2 over a 14-month study period in 2017–2018. IMR encompassed privately-owned land in Collier and Hendry counties that included a mosaic of native cover and active agricultural land uses (*e.g.,* improved and semi-improved pastures for cow-calf operation and a variety of row crops). These results suggest that the increasing size of the panther population post-introgression has resulted in higher densities in the range of 1.37–4.03/100 km^2 in occupied habitats on public and private lands in South Florida. However, densities in other areas within the range of panthers have not been studied.

5.1.6 Conservation Needs and Threats

There are a variety of threats that have long been identified as affecting the viability of the panther population. The most substantial threats include habitat loss, fragmentation, and degradation from development and climate change; and mortality from vehicle collisions. Other stressors include illegal shootings; exposure to infectious disease; exposure to contaminants; and small population size, but the effects of these stressors to the population are not well documented (Harris 1984, Maehr 1992, 2008, Onorato et al. 2010, van de Kerk et al. 2019, FWC 2017, USFWS Draft 2020). In addition, the most recent population viability analysis (PVA) performed by van de Kerk et al. (2019) found that maintaining the genetic health of the panther population is important to long term viability.

Conservation needs that address the most substantial threats listed above include the following:

Conserving, restoring, and managing lands that are capable of maintaining and expanding panther population(s) throughout Florida (Federal, State, Local, and other). Land conservation measures include public acquisition of conservation lands and conservation easements, establishment of panther conservation banks, protection of panther habitats by wetlands mitigation banks, NRCS purchase of easements to protect wetlands, and management efforts of Native American tribes. As mentioned in section 5.1.3., 63 percent (5,696 km^2) of the panther Functional Zone is in conservation. Management actions that affect panthers include prescribed fire, exotic plant removal, population monitoring, hydrologic restoration, vegetation plantings, silvicultural operations, public outreach and education, recreation management, and maintenance of utility corridors.

Maintenance of wildlife linkages that allow for a permeable landscape and that connect conservation lands that can support panthers. The maintenance of wildlife linkages is a major consideration in determining where to seek land acquisition, conservation easements, and to use other methods to secure conservation lands. The Dispersal Zone (section 5.1.3) is an important wildlife linkage for the panther because it provides access to areas where the panther population could expand north of the Caloosahatchee River. Other important linkages in southwest Florida (*e.g.,* Camp Keais Strand and Okaloacoochee Slough) maintain connectivity between areas of protected panther habitat. Wildlife underpasses with fencing have become an important tool to help offset projected increases in panther mortalities resulting from increases in traffic within panther habitat. Based on demonstrated use of wildlife crossings by panthers and prey, over 60 crossings and enhancements to existing bridges have been completed in other locations where panther vehicle mortalities have been frequent (USFWS Draft 2020). When wildlife underpasses are used to minimize effects of a development project, they also reduce effects of other sources of traffic using the same road.

The most recent population viability analysis (PVA) performed by van de Kerk et al. (2019) found that models which didn't include information about inbreeding effects on the population indicated the probability of extinction at 100 years was approximately 1.4 percent. However, when they included information about the genetic health of the population, they found extinction probabilities within 100 years ranged between 13 and 17 percent, but that genetic augmentation of the population at 10 year intervals reduced this range of possible extinction to between 6 and 10 percent. Thus, in addition to land-based conservation needs, the genetic health of the population must be maintained in order to maximize the likelihood of its persistence.

5.1.6.1 Habitat Loss

Authors of scientific literature often use the terms habitat loss and habitat degradation interchangeably (Lindenmayer and Fischer 2006). However, habitat loss and habitat degradation are not the same. Habitat loss is the complete loss of suitable habitat for a given species, or the functional loss of otherwise suitable habitat through the loss of the species' access to it. In the former case, humans can cause habitat loss by converting suitable habitat to human use, while in the latter case habitat loss occurs when barriers close off a remnant of access to otherwise suitable habitat during the process of fragmentation (SECTION 5.1.6.2). Habitat degradation, on the other hand, refers to the qualitative reduction of habitat services for a species that continues to have access to it, though it is possible to degrade habitat to such an extent it is effectively lost to the species (SECTION 5.1.6.3).

Habitat loss has been identified as a key factor affecting the long-term viability of the panther population (Maehr 1992, USFWS 2008, Onorato et al. 2010, van de Kerk et al. 2019). Survey data of land use/land cover in Florida have been available since 1936 when the U.S. Forest Service completed their first forest inventory for Florida (Kautz 1998). More detailed statewide vegetation data derived from satellite imagery have been collected since the late 1980s through as recent as 2015 (Kautz et al. 1994, Kautz et al. 2007, FWC 2016). These data have been used for the draft Florida Panther SSA (USFWS Draft 2020) to estimate historical loss of panther habitat in Florida during three time periods: 1936–1987; 1987–2003; and 2003–2015.

Forest cover has been demonstrated repeatedly as a key component of landscapes used by panthers in Florida (Belden et al. 1988, Maehr and Cox 1995, Comiskey et al. 2002, Cox et al. 2006, Kautz et al. 2006, Land et al. 2008, Onorato et al. 2011). Using forest cover as an index to panther habitats, Kautz (1998) reported that 17,677 km^2 of Florida forests were converted to agricultural or urban uses between 1936 and 1987, which was a total loss of 20.8 percent and a rate of loss of 0.41 percent per year. During the same period, forests declined by 3966 km^2 (33 percent) in 10 South Florida counties, a rate of loss of 0.65 percent per year (Kautz 1994). Kautz et al. (2007) reported the results of a change detection analysis that compared land use/land cover in Florida between 1987 and 2003 and found a total of 367 km^2 of natural habitats in the Primary Zone (4.4 percent of the Primary Zone) was converted to other uses at a rate of loss of 0.28 percent per year. Lastly, Dr. Robert Kawula (FWC, unpublished data) completed a change detection analysis of South Florida habitats by comparing 2003 land cover data (Kautz et al. 2007) with a land cover database from 2015 (FWC 2016) and found a total of 144 km^2 of natural and semi-natural habitats in the Primary Zone (1.56 percent of the Primary Zone) was converted to other uses between 2003 and 2015, a rate of loss of 0.13 percent per year.

Between 1987 and 2003 just over half of the conversions of natural areas in the Primary Zone (55-57 percent) were to agricultural uses. Between 2003 and 2015, 41–42 percent of natural and semi-natural panther habitats lost were to urban development, while 25–27 percent were lost to conversions to agricultural use. Whether lands converted to agricultural use constitute a loss or degradation of habitat for panthers is a function of the proximity of agricultural lands to forest edges. Specifically, Land et al. (2008) and Onorato et al. (2010) found that panthers will use agricultural lands within 300 m of a forest edge in proportion to their availability, but avoid agricultural lands farther than 300 m from a forest edge.

Panthers can also temporarily lose the use of otherwise suitable habitat because of temporary or periodic events that prevent panthers from accessing them, such as might occur during high water events in the South Florida rainy season or because of periods of temporary human disturbance (Janis and Clark 2002, Sweanor et al. 2008, McCarthy and Fletcher 2015, Criffield et al. 2018, McCarthy and Fletcher 2015, Abernathy et al. 2019). Additionally, panthers may permanently lose use of otherwise suitable habitat when human presence and activity near them become permanent, because panthers tend to avoid areas of sustained, high density human activity and may face high risk of mortality if they don't (Frake et al. 2015, Moss et al. 2016b, Blecha et al. 2018).

Loss of habitat that supports prey important to panthers is also problematic because prey abundance, distribution, and behavior dictates these same attributes among populations of *Puma concolor* everywhere they occur (Smith and Bass 1994, Dalrymple and Bass 1996, Riley and Lalecki 2001, Grigione et al. 2002, Laundre et al. 2007, Laundre et al. 2009). Loss of habitat supporting prey can have secondary effects that may intensify intraspecific competition (competition within a species); intensify interspecific competition (competition between species) (Murphy et al. 1995, Allen et al. 2013, Elbroch and Wittmer 2013, Allen 2014, Elbroch et al. 2015); increase rates of depredation; and increase instances of prey switching (Moss et al. 2016a & b, Robins et al. 2019). Depredation and the consumption of lesser-preferred prey by panthers have become more prevalent as the population has grown (Tables 5-1 & 5-2, Caudill et al. 2019).

These secondary effects of habitat loss may increase the likelihood of mortality among individual panthers from all causes, such as interspecific aggression, predation from bears or coyotes, disease, bioaccumulation of toxins, illegal shootings, vehicle collision, and management removal (Vickers et al. 2015, Moss et al. 2016b, Blecha 2015, Blecha et al. 2018). We provide a more precise description of hese effects to panthers in separate, appropriate sections of this chapter.

5.1.6.2 Habitat Fragmentation

Habitat fragmentation is defined as the subdivision of larger contiguous patches of habitat into smaller patches by the emergence of barriers that severely restrict or preclude the ability of individuals to access the habitat fragment (Lindenmayer and Fischer 2006). Such is the case with the panther, whose range has been systematically fragmented by a combination of road networks, residential development, and canals (USFWS Draft 2020). Roadways with high volumes of traffic create the principle barriers between these fragments. Charry and Jones (2009) found traffic volume of 100-500 trips/day began affecting all taxa, including large carnivorous mammals like *Puma concolor,* that impacts increased in severity up to 10,000 vehicles per day, and that at 10,000 or more vehicles/day, traffic levels often observed on interstates and multi-lane highways, created a near complete barrier to all taxa except for birds (Appendix C).

Schwab and Zandbergen (2011) found that when it comes to panthers, specifically, major roads present a stronger barrier to movement than minor roads, with females being significantly more reluctant to cross roads than males even when wildlife underpasses are present for them to use. Furthermore, Schwab and Zandbergen (2011) observed these roadways frequently serve as boundaries of female panther home ranges and their analysis of telemetry records indicated many of these individuals may spend a great deal of time near roadways without attempting to cross them. Schwab and Zandbergen (2011) concluded, "Road networks in south Florida have essentially segregated the movement of the sexes and have fragmented the limited remaining habitat of the Florida panther." Wildlife crossings produce relief from fragmentation caused by road networks, but this relief does not fully offset the barrier effect generated by these roadways. Smaller habitat patches, once isolated by fragmentation, may be too small to support an independent, viable population or subpopulation of individuals (Crooks 2002, Vickers et al.

2015), and inbreeding depression and/or reduction in population viability could result (Ernest et al. 2003, Seth at al. 2014, Vickers et al. 2015, Benson et al. 2019).

5.1.6.3 Habitat Degradation

Habitat degradation is a process that makes habitat less suitable or less available to such an extent that a species breeding, feeding, or sheltering behavior is impaired (Lindenmayer and Fischer 2006). This means a species may still inhabit an area where habitat degradation occurs, but certain life history functions, such as reproduction, may no longer be as successful. Under the Endangered Species Act habitat degradation constitutes "Harm" whenever "significant habitat modification or degradation actually kills or injures wildlife by significantly impairing essential behavioral patterns including breeding, feeding or sheltering" (USFWS 1998).

Decline in Prey Availability

Degradation of habitat that supports populations of prey important to panthers is a threat to their survival and recovery because prey abundance, distribution, and behavior influences these same attributes among populations of *Puma concolor* (Smith and Bass 1994, Riley and Lalecki 2001, Riley and Lalecki 2001, Grigione et al. 2002, Laundre et al. 2007). One form of habitat degradation occurs in response to introductions of invasive species, their introduction into natural systems largely being a function of human presence on the landscape and trade between regions (Hulme 2008). For example, the presence of invasive species like the Burmese python can degrade the value of otherwise suitable habitat to panthers by preying on species important to panthers or by preying on panthers, directly (Dorcas et al. 2012, Wilson 2017, Caudill et al. 2019). Conversely, the introduction of other invasive species have been beneficial for the Florida panther. In the 1500s European wild hogs were introduced near Big Cypress and wild pigs were well established by the 1900s (Belden and Frankenberger 1977). This alternative source of prey, along with the introduction of armadillos in 1924 (Taulman and Robbins 1996), may have allowed the panther population to persist during the period of general deer population decline that took place at this time.

Current Prey Availability and Recent Declines: In general, deer populations in South Florida are characterized by lower density and fecundity than in other areas of the state, primarily due to seasonal flooding, climatic stress, and the thin, nutrient poor soils that contribute to the low nutritional value of available forage and overall poor habitat quality (Harlow and Jones 1965, Fleming et al. 1994, Labisky et al. 1995, Garrison et al. 2011). Market, subsistence and trade hunting of deer pre-1900 were substantial in the area and similar to areas in eastern U.S. and throughout the southeast, likely contributed to the decline of prey and the imperilment of the panther population (Schortemeyer et al. 1991, Gill 2010). The white-tailed deer herd in Florida reached its lowest point near the end of the 1930s (FWC 2007). A white-tailed deer eradication program that began in Florida during the late 1930s to control the cattle-fever tick resulted in the extermination of 9478 deer between 1939 and 1943, including 8428 deer killed in Collier County (Davis 1943, Game and Fresh Water Fish Commission 1946, Alvarez 1993). The introduction of New World screwworm fly (*Cochliomyia hominivorax*) in 1933 also undoubtedly had an impact on deer populations in Florida. Concomitant with the reduced deer populations was a reported increase in panther livestock depredation and persecution of panthers in the region (Hamilton 1941). The low point was followed with decades of harvest regulations and their enforcement, reduction of subsistence hunting, screwworm eradication in 1958, re-introduction of deer from other states, increased habitat availability and quality (due to logging and drainage program), and habitat protection through the creation of state wildlife management areas. And despite the substantial increase in human activity and development during this period, the deer herd flourished. Prey management was recognized as important, evident in the conservative hunting regulations (e.g., buck-only harvest) and land acquisition (e.g., purchase of the FPNWR).

Deer herds in the southeastern portions of the panther's occupied range have a history of extreme population fluctuations and have been subjected to severe, weather-related mortality events (Loveless 1959, Forrester 1992, Maehr and Lacy 2002). Although extreme water events are rare, the hydrological changes in the last decades in general have resulted in the increased depth and duration of hydroperiods. This change in hydrology, along with other landscape-level changes, has potentially impacted both deer and wild hog populations. Harvest and aerial monitoring data suggest both ungulate species have experienced population declines in portions of South Florida. For example, feral swine harvest on BNCP averaged 125.7 head/year during 1993–2003 and 2.4 head/year during 2004–2015, with no harvest in recent years (FWC 2020a). Deer harvest has followed a similar declining trend in some management units, while elsewhere harvest appears to be stable or increasing.

The most drastic declines in the white-tailed deer populations have been observed in the southern portions of BCNP (south of U.S. Highway 41 [US 41]) since the early 2000s. Recent survey and harvest data indicate a near complete population crash in this region (FWC unpublished data). Further south in ENP, based on anecdotal evidence, deer and other mammals have declined since 2000, or even earlier (Garrison et al. 2011). This drastic population decline in white-tailed deer has undoubtedly impacted the quality and suitability of habitat for panthers in this region. The causes for this decline are unknown, but analyses of hydrological data suggest that increasing water levels since 1995 have had a negative effect on the deer population (Garrison et al. 2011). However, the authors caution that the decline is likely due to a combination of factors that interact with high water levels, including predation, disease, and habitat degradation (Garrison et al. 2011). Extreme fluctuations in hydrological conditions caused by seasonal flooding, weather events (e.g., tropical storms), and manmade water impoundments, can increase stress and vulnerability to predation, diseases, malnutrition, and negatively influence reproduction, recruitment of fawns, and adult deer survival (Loveless 1959, Fleming et al. 1994, Labisky et al. 1995, MacDonald-Beyers and Labisky 2005, Garrison et al. 2011).

The role that predation by panthers or other predators played in the severe deer declines in southeastern Florida is not fully understood as it is unlikely that a single predator-prey model accurately represents the predator-prey system in southeastern BCNP and ENP at all times (Gese and Knowlton 2001). This area has traditionally supported fluctuating deer and panther populations and it is likely that panther numbers "reflect the relative abundance and stability of local prey populations" (Maehr and Lacy 2002). Maehr and Lacy (2002) postulated that severe deer population nadirs in South Florida may prevent continuous occupation of a large carnivore population. The authors characterized the predator-prey system in South Florida as a stable-limit cycling model (Ballard et al. 2001) and further cautioned that the deer herd in southeastern Florida could be reduced or a herd increase neutralized by an artificial and rapid increase in a large predator population (Maehr and Lacy 2002). However, the recurrent fluctuations model (Gese and Knowlton 2001) may better approximate the relationship between panthers and deer in South Florida as the deer herd may never reach a state of equilibrium due to the interactive effects of a nutrient poor habitat, fire, seasonal flooding, and predation.

Burmese Python Impacts on Prey Availability: Burmese pythons (*Python bivittatus*), a non-native invasive apex predator from southeast Asia, are well-established in South Florida and have been associated with declining mammal populations due to predation and resource competition (Holbrook and Chesnes 2011, Dorcas et al. 2012, McCleery et al. 2015). Burmese pythons were likely first introduced in the southern portions of ENP prior to 1985 via releases or escapees from private ownership (Wilson et al. 2011). Pythons were encountered regularly in the region beginning in the mid-1990s; however, it was not until the early 2000s that they were first recognized as being established in ENP (Meshaka et al. 2000, Wilson et al. 2011). As of 2018, breeding populations of Burmese pythons have been documented across South Florida, including areas within the occupied range of the Florida panther in ENP, BCNP, and areas within and surrounding Collier Seminole State Park, PSSF, and Rookery Bay National Estuarine Research Reserve.

Burmese pythons are habitat generalists and radio-tracked pythons in ENP used a mosaic of habitat types and exhibited frequent use of elevated tree islands within a freshwater wetland matrix (Hart et al. 2015). Pythons are large, ambush predators that can grow up to 20 feet in length and have few natural predators. Free-ranging Burmese pythons in Florida are generalist predators that consume a variety of prey species, including birds, mammals, reptiles, amphibians and fish (Snow et al. 2007, Rochford et al. 2010, Dove et al. 2011). Burmese pythons have been correlatively associated with severe declines of mammals in ENP, including marsh rabbit (*Sylvilagus palustris*), raccoon, and white-tailed deer (Holbrook and Chesnes 2011, Dorcas et al. 2012). McCleery et al. (2015) empirically demonstrated that pythons caused reductions in marsh rabbit populations in ENP. All these species are prey for Florida panthers, and thus the presence of Burmese pythons may be having an adverse effect on the panther prey base.
Python predation on white-tailed deer has been confirmed throughout the established breeding range of this invasive constrictor (Rochford et al. 2010, Boback et al. 2016, Bartoszek et al. 2018). Although the extent of the impact of python predation on white-tailed deer population is unknown or speculative, some noteworthy python predation events on deer have been reported that illustrate the potential threat that pythons pose as a non-native competitor to panther prey resources in South Florida. These noteworthy events include a single adult python (4.32 m in length, 48.3 kg) consuming one adult deer and two fawns within a period of several months in ENP (Boback et al. 2016) and a comparatively smaller python (2.94 in length, 14.3 kg) in Collier County consuming a fawn (15.9 kg) that was 111.1 percent of the mass of the snake (Bartoszek et al. 2018). Burmese pythons represent a novel predatory threat to the native prey populations of the panther in South Florida, including white-tailed deer (Boback et al. 2016).

Disease Impacts on Prey Availability: White-tailed deer in Florida are at risk to infectious disease outbreaks that could reduce white-tailed deer populations and adversely affect the availability of panther prey. These diseases include bluetongue and epizootic hemorrhagic disease viruses (collectively referred to as hemorrhagic disease viruses), both considered to be the most important infectious diseases of white-tailed deer in Florida and the southeastern U.S. (Forrester 1992). White-tailed deer populations in Florida are also at risk from the New World screwworm (NWS) fly larvae. The negative effect of this infestation was demonstrated when NWS eradication efforts initiated in southeastern U.S. in 1958 resulted in dramatic increases in the white-tailed deer herds in South and Central Florida in the 1960s (Forrester 1992). A recent NWS infestation detected in the Lower Florida Keys in 2016 impacted the population of Florida Key deer (*O. v. clavium*) but was successfully managed and contained with no infestations detected in deer herds on the Florida peninsula (Lopez et al. 2016, Parker et al. 2017, Skoda et al. 2018). The recent NWS infestation in the Florida Keys highlights the need for continued surveillance to detect future occurrences and for rapid response plans to contain and eradicate future infestations (Forrester 1992).

Of greater concern would be the introduction of chronic wasting disease (CWD) or heartwater disease—either of which could have long-term, negative impacts on deer populations. Chronic wasting disease is a transmissible spongiform encephalopathy of cervids that is slowly spreading across North America. Management efforts to contain or eradicate the disease in areas where it occurs have largely been ineffective, and in some regions the disease is negatively impacting deer densities. Although CWD has not yet been detected in Florida it has recently been found in TN and MS. Heartwater disease is caused by the bacteria *Ehrlichia ruminantium*. The bacteria is vectored by ticks, and in the southeastern United States, the Gulf Coast tick (*Amblyomma maculatum*) is a competent vector. Prevalence of infections is associated with proximity of deer to human development (Farnsworth et al. 2005).

Land Management Impacts on Prey Availability: Habitat management via prescribed fire is a critical conservation tool that has a positive influence on increased prey availability (Garrison and Gedir 2006). Large areas of the most important habitats occupied by panthers are on publicly owned conservation lands, including BCNP, FPNWR, FSPSP, PSSF, ENP, OSSF, Dinner Island Wildlife Management Area (WMA), Spirit of the Wild WMA, and others. How public lands are managed has the potential to affect panther habitat and prey populations via: prescribed fire, hydrologic alterations, levels of recreational uses, prevalence of invasive exotic plant communities, conversions from natural to plantation forests, and other activities. However, a prime goal in the management plans for most of these lands is to restore and maintain the areas in a natural state, which ultimately favors panther habitats and prey.

Summary: Habitat degradation affects panthers presently and is likely to continue in the absence of habitat restoration and management. Human degradation or alteration of habitats through logging and land clearing, oil and gas development, recreational use, or overhunting of prey species important to panthers degrade the value of habitat for panthers by decreasing the abundance of prey (Paviolo et al. 2009, Logan and Sweanor 2010). Additionally, the introduction of new urban and exurban can degrade the value of habitat by concentrating prey species away from areas of otherwise suitable habitat through supplemental feeding (Storm et al. 2007). Such concentration increases their exposure to diseases which can negatively impact the prey population well beyond the wildland/urban interface to the detriment of panthers (Edmunds et al. 2016, Bradley and Altizer 2007). Urban and exurban development also typically cause a shift in prey availability, from larger prey to smaller prey, that can also diminish the value of otherwise suitable habitat in adjacent areas for panthers (Burdett et al. 2010, Moss et al. 2016a, Smith et al. 2016). Lastly, prey populations may also decline through natural processes that permanently or temporarily make habitat less suitable for them. These include, but are not limited to: forest succession, forest dieback and pathology, seasonal flooding, and drought.

<u>Human Activity</u>

The absence of human development and activity is one of the strongest predictors of panther presence and abundance (Dickson and Beier 2002, Paviolo et al. 2009, Burdett et al. 2010, Frakes et al. 2015) because panthers tend to avoid human activity or face a high risk of mortality if they don't (Markovchick-Nicholls 2008, Sweanor et al. 2008, Sweanor and Logan 2010, Foster et al. 2010, Schwab and Zandbergen 2011, Morrison et al. 2014, Wilmers et al. 2015, Burdett et al. 2010, Moss et al. 2016a). At all phases of development (clearing, construction, use, and maintenance) human activities produce noise, dust, and smoke, and these can penetrate panther habitat by as much as 300 to 1,000 meters (Draft HCP 2019), depending on the source. Typically, the effect of human activity on panthers and other *Pumas* is initially behavioral in nature, with panthers avoiding areas of human activity or changing their predatory behavior in the presence of it (Blecha et al. 2015, Smith et al. 2015, Benson et al. 2016, Moss et al. 2016a, Moss et al. 2016b, Blecha et al. 2018). The extent and duration of their avoidance of areas of human activity is typically proportional to its duration, extent, and intensity. Specifically, short-term, localized, low intensity human disturbances usually result in similarly short-term, localized, habitat avoidance among panthers (Janis and Clark 2002, Sweanor et al. 2008, McCarthy and Fletcher 2015, Criffield et al. 2018, Abernathy et al. 2019) whilst long-term, spatially expansive, high intensity human activities typically cause near permanent, functional, landscape-scale loss of otherwise suitable for panthers (Frakes et al. 2015, Wilmers et al. 2015, Blecha et al. 2018). Wherever the presence of human activity becomes permanent otherwise suitable habitat for panthers can be regarded as degraded because their use is limited by the behavioral response of panthers to noise and other manifestations of human activity that lead to their avoidance.

Human presence on the landscape also indirectly degrades habitat by impairing habitat management activities beneficial to panthers or their prey by reversing habitat degradation via natural processes, discussed in the previous section (Section 5.1.6.3.**)**. Specifically, the presence of residential and commercial development often makes it difficult for management agencies to use prescribed burning to manage habitat for the benefit of species like white-tailed deer and panther, or to allow natural fires to run their course without suppression. In the absence of smaller-scale, prescribed burning at fixed intervals of time or naturally occurring fires allowed to burn without suppression, the mosaic of forest cover, open-canopy forest, and patches of early succession rich in forbs optimal for the deer population would be lost through natural processes of forest succession (Dees et al. 2001, Main and Richardson 2002). Thus, the reduction of this form of human activity could constitute habitat degradation that is ultimately detrimental to panthers.

In less developed areas human activity can lead to locally high concentrations of panther prey and panthers that are also, ultimately, detrimental to both. Specifically, lands managed to maximize the abundance of species such as white-tailed deer, wild hog, wild turkey, and raccoons undoubtedly increase the availability of prey for panthers and this, in turn, increases ability of landscapes to sustain high densities of panthers (FWC unpublished data). Such is often the case on lands owned or leased for the purpose of hunting, where habitats are managed to benefit these species and supplemental feeding is provided to attract and sustain species desirable for hunting. Likewise, livestock operations where cow-calf operations or other livestock species amenable to panther depredation are present, such as goats or sheep, may attract and sustain a large number of panthers (Interagency Florida Panther Response Team, 2017). However, as mentioned in Section 5.1.6.6. supplemental feeding and other forms of resource provisioning can concentrate prey species in high densities typically not found in nature, and this may cause them to be more susceptible to the spread diseases that ultimately, negatively impacts their population (Bradley and Altizer 2007). Likewise, reliance of panthers on livestock for their needs increases the chances they may be subject to illegal shootings or management removal. Furthermore, the concentration of panthers near either human activity may bring panthers into closer proximity to one another, increasing the possibility for interspecific aggression or disease transmission between individuals. Where these risks are more often realized than the benefits associated with these activities, their net effect on the value of affected habitat could only be characterized as a form of degradation.

<u>Environmental Contaminants</u>

Environmental contaminants are chemicals that accidentally or deliberately enter the environment, often because of human activities. Environmental contaminants present a potential threat to panther health, reproduction and survivorship, and many have been detected in panthers (Facemire et al. 1995). Environmental contaminants detected in panthers include mercury, poly-chlorinated biphenols (PCB), organochlorides (OCs), and anticoagulant rodenticides (Jordan 1990, Newman et al. 2004, Brandon 2011, Cunningham 2012). Though no panther deaths to date are attributed solely to contaminant exposure, it is likely contamination with one or more environmental toxins can and have caused subclinical health effects. The effects of environmental contaminants in panthers is an ongoing area of research and monitoring, and is required as the subtle long-term effects of contaminant exposure is often challenging to prove until population declines occur (World Health Organization and United Nations and Environment Programme 2013).

Panthers may have a higher risk of exposure to contaminants because they consume a wider variety of prey than is typical of *Puma concolor*, generally, (Iriarte et al. 1990) and this broader generalization of prey creates many pathways of exposure (Roelke et al. 1991). Furthermore, because panthers are apex predators, they are at higher risk of toxin bioaccumulation that leads to serious impairment of life functions, behavior, or death (Cleckner et al. 1998). Lastly, panther exposure to contaminants can vary by time and place (Cunningham 2012) because the availability of prey species varies in response to environmental and demographic stochasticity, seasonal weather cycles, rare major events, proximity of panthers to development, and human activity (Richter and Labisky 1985, Roelke et al. 1991, Fleming et al. 1994).

In 1993, the Service issued a programmatic biological opinion to the Environmental Protection Agency (EPA) finding common poisons used to kill rats, the anticoagulant rodenticides (AR) chlorophacinone, diphacinone, pival, and sodium cyanide, jeopardized the continued existence of panther and several other South Florida listed species (USFWS 1993). However, in 2012, Mark Cunningham (FWC) reported that the tissues of 20.6 percent (7 of 34) panthers tested post-mortem contained 2 ARs not addressed with respect to panthers in the 1993 BO: brodifacoum and bromodiolone. Though they were killed in vehicle collisions, the concentrations of these ARs in 2 of the affected panthers was comparable to concentrations measured in 4 *Puma concolor* killed by AR toxicosis in the Santa Monica Mountains National Recreation Area (SMMNRA; Riley pers com), and the concentration of these in Florida panthers appears to be increasing over time and in proximity to areas of human development (Appendix D).

5.1.6.4 Motor Vehicle Mortality

Vehicle collisions are a significant source of mortality for panthers (Figure 5-4). This mortality directly affects the panther population by reducing the panther population size and potential for population growth and expansion. Panther mortality from vehicle collisions is presently the highest source of mortality for panthers and has increased significantly since 1972 (Figure 5-5). Much of the increase in mortality is strongly correlated with an increasing panther population size, but this trend is also colinear with the growth in the human population and in recent years the coupling of panther population size and vehicle mortalities has weakened with panther population size explaining less of the annual variation in panther/vehicle mortality (Figure 5-6). The FWC documented 351 vehicle-related panther mortalities and 8 vehicle-related panther injuries from 1972 to 2018 on highways in south Florida. Most of these incidents involve male panthers (60 percent), while 40 percent of collisions involve female panthers. Collisions with motor vehicles killed an average of 28 panthers each year over the past five years. Assuming an adult population size of 120 to 230 individuals, this means vehicle collisions kill between 12 and 23 percent of adult panthers, annually.

Charry and Jones (2009) performed a meta-analysis of numerous studies investigating the impact of traffic volume on various wildlife taxa and identified increases in daily trip counts as a source of substantial negative effects to species that include habitat fragmentation and roadway mortality. In South Florida increases in traffic typically follow the construction of new residential and commercial developments. New developments also affect existing traffic patterns when they introduce popular commercial establishments that were previously uncommon or bring new, large nexuses of employment. These effects on traffic volume and distribution on roadways are regularly attributed to developers by local, state, and federal agencies. Many methods exist for the purpose of estimating the likely amount of new traffic coming from or going to new developments based on the number of residences and businesses, and these are typically used to assess the transportation impact fees levied against developers by local and state authorities. Just as local governmental entities typically do when it comes to assessing the need for transportation impact fees, we also attribute traffic changes caused by the construction of new residential and commercial developments to the developers that build them.

However, we recognize that local, state, and federal entities may take actions that incentivize new development, and that when this occurs, they may bear some responsibility for the traffic generated when new residential and commercial development is manifested on the landscape. It may be difficult to determine and incorporate multiple sources of causation for traffic increases into our consultations, we nonetheless incorporate them, when applicable, because we know increases in traffic volume increase the probability of panther mortality due to vehicle strikes. When other sources of influence on traffic volumes and distribution on the transportation network are identified, those that are likely to be non-federal (approximately 25 percent) will be accounted for in the Cumulative Effects analysis, while those that are likely to result from federal funding, authorization, or action will be consulted on at the time they are brought forward to the Service during the section 7 interagency consultation process.

We do not include predicted mortality from vehicle strikes in the take statement for a particular project because it is often impossible to identify the individual responsible for the collision, much less to ascertain whether that individual was leaving or entering the area of new development. Furthermore, design and maintenance of roadway facilities by local and State government can have an influence on wildlife roadway mortality, as can individual driver skill and behavior. That said, it is reasonably certain that increased traffic generated by new developments will increase the risk of panther-vehicle collisions. To manage the increased risk of vehicle collisions with panthers, the Service recommends the Action facilitate the construction of wildlife underpasses, or crossings, that can reduce vehicle collisions with panthers that wouldn't occur but/for the increased traffic volume associated with new development. Underpasses allow panthers and other wildlife to safely cross under busy roadways, and maintain connectivity and gene flow within the panther population. Underpasses usually consist of a bridge, prefabricated concrete box, or culvert (Forman et al. 2003). A number of wildlife crossings with associated fencing have already been constructed on major roadways in southwest Florida to benefit the panther and other wildlife species. The effectiveness of these crossings in reducing overall mortality from vehicle collisions is estimated in Section 5.2.2.4. The Service also recommends maximizing internal trip capture for all new developments to reduce the number of vehicle trips on roads connecting developments, thereby reducing the likelihood of panther vehicle collisions.

5.1.6.5 Illegal Shooting

Illegal shootings have been documented, but the magnitude of the problem is unknown. These illegal takings result in the loss of individuals within the population (USFWS Draft 2020). Gunshot injuries resulting in immediate death or found at necropsy following death from other causes are common. The FWC records 34 panthers wounded or killed by gunshot, and one killed by arrow, between 22 May 1983 and 7 October 2018. Nineteen shootings of the 34 documented (55.9 percent) occurred within the last 10 years. This suggests shootings of panthers are increasing, possibly in response to the growth of the panther population. In a number of cases, evidence of gunshot was discovered during necropsy of an individual that died of collision with a motor vehicle. It is possible, then, that panthers that survive a gunshot injury may be predisposed to injury or mortality by other causes (e.g., vehicle strike or intraspecific aggression). This may be due to incapacitation of the panther because of secondary infections, lameness, and loss of ability to hunt. Discovery of gunshot wounds after death from other causes also indicates panthers are shot more often than reported. Therefore, the degree to which shootings are a threat to the panther population is not known, but shootings resulting in the loss of individuals from the population could potentially reduce the viability and recovery of the panther.

5.1.6.6 Disease

Several infectious diseases have caused mortality in panthers and their prey, and an outbreak of these are a threat to the health and recovery of the population (USFWS Draft 2020). Of particular concern are feline leukemia, rabies, pseudorabies, feline viral rhinotracheitis, feline calicivirus and feline panleukopenia, feline immunodeficiency virus (FIV), and dermatophytosis (ringworm), all of which pose a significant risk to individuals and the panther population as a whole. (FWC 2020a). For example, between 2002 and 2004, an outbreak of FeLV resulted in the deaths of at least five Florida panthers, and since 2010, infections have been diagnosed in six additional panthers. Through genetic analyses of the infecting virus, biologists determined the outbreak likely came from a cross-species transmission from a domestic cat. Panthers are known to prey upon domestic cats that roam freely outdoors. Similarly, 6 Florida panthers have been documented as killed by pseudorabies, which they contract from consuming infected prey like wild hogs.

Roelke (1990) found 65 percent of panthers were exposed to, or infected by, feline panleukopeina virus, 43 percent were exposed or infected by feline calicivirus; and 23 percent were exposed or infected by feline enteric corona virus. Roelke (1990) also found 25.6 percent were exposed to, or infected by, feline immunodeficiency virus; 26 percent exposed to rabies virus; 33.3 percent were exposed to feline syncytia-forming virus; 8 percent were exposed to *Toxoplasma gondii*, and 2.4 percent were exposed to *Brucella*. Some of these diseases are transmitted by domestic animals. Increased development and concentration of prey could increase the risk to panthers and their prey if domestic animals aren’t contained indoors or properly vaccinated, or if prey species concentrate in areas of human development as a refugia from predation (Bradley and Altizer 2007, Razgūnaitė et al. 2009). Transmission of vector-borne diseases and prey choices among felids like panthers may also be influenced by changes in precipitation and temperature resulting from climate change (Mas-Coma et al. 2008, Khorozyan et al. 2015, VanWormer et al. 2016).

Panthers in the Action Area also now exhibit feline leukomyelopathy (FLM), a disorder of unknown origin that evidenced by nerve damage detectable during necropsy. In one case, severe deterioration of a panther’s health with no prognosis of recovery required humane euthanasia. To date, FWC has confirmed FLM in 2 panthers and 6 bobcats. Trail camera footage has also captured nine panthers (mostly kittens) and four adult bobcats displaying signs and behavior consistent with this condition (FWC 2020a). Though the exact cause for feline leukomyelopathy is still under investigation, the symptoms are generally consistent with neuropathy reported in response to traumatic injuries, infections, metabolic problems, exposure to toxins, or a combination of these.

5.1.6.7 Climate Change

Our analyses under the Act include consideration of observed or likely environmental effects related to ongoing and projected changes in climate. As defined by the Intergovernmental Panel on Climate Change (IPCC), "climate" refers to average weather, typically measured in terms of the mean and variability of temperature, precipitation, or other relevant properties over time; thus, "climate change" refers to a change in such a measure which persists for an extended period, typically decades or longer, due to natural conditions (*e.g.,* solar cycles) or human-caused changes in the composition of the atmosphere or in land use (IPCC 2013, p. 1450). Because observed and projected changes in climate at regional and local levels vary from global average conditions, rather than using global scale projections, we use "downscaled" projections when they are available. In our analysis, we use our expert judgment to weigh the best scientific and commercial data available in our consideration of relevant aspects of climate change and related effects. Based on the observed trends in the climate record gathered from thousands of temperature and precipitation recording stations around the world and changes observed in physical and biological systems, the scientific community is certain that the earth's climate is changing and a warming trend in the climate is occurring (USGS 2019).

Florida is vulnerable to pulse events and sea level rise as well as to changes in rainfall and temperatures expected due to changes in environmental trends. NOAA (2017) model simulations using the more recent Coupled Model Intercomparison Project Phase 5 (CMIP5) predicts changes in precipitation seasonally for South Florida with increases in dry season rainfall up to 20 percent and decreases in wet season rainfall up to 30 percent. The change in timing of rainfall will likely stress ecosystems and cause changes in vegetation types. Sea level rise (SLR) of 1m by 2070 is projected under NOAA's Intermediate-High, High, and Extreme Scenarios and the CARSWG Highest scenario (Noss et al. 2014, Hall et al. 2016, Kirtman et al. 2017, Sweet et al. 2017, USGCRP 2017, USGCRP 2018). SLR of this magnitude will inundate 405,006 acres (1639 km^2; 18 percent) of the panther's current range (Figure 5-7, USFWS Draft 2020). Recent observations indicate SLR rise in the Southeastern United States, and South Florida in particular, is accelerating at a faster rate than previously estimated (Boon et al. 2012, Ezer 2019, VIMS 2020). If so, the amount of panther habitat lost through SLR may exceed 18 percent in 2070. In addition, climate change may also alter habitat used by panthers and their prey, with an increase in dry season rainfall increasing water levels and hydro-periods during denning and fawning, and plants that serve as food resources being more dormant. A decrease in wet season rainfall will likely lead to lower water levels and increased droughts during reproductively sensitive times for panthers and prey. The changes in rainfall will likely affect our ability to conduct prescribed burns during preferred times of the year.

It is difficult to estimate, with any degree of precision, which species will be affected by climate change or exactly how they will be affected. The Service will use Strategic Habitat Conservation planning, an adaptive science-driven process that begins with explicit trust resource population objectives, as the framework for adjusting our management strategies in response to climate change (USFWS 2006). Changes in precipitation may alter wildfire patterns (Fill et al. 2019) in this fire-dependent ecosystem. Changes in precipitation can also alter the distribution and prevalence of infectious diseases, prey distribution, or temporarily fragment or aggregate panther populations and/or their prey, which could affect essential life functions and increase exposure to disease.

5.1.6.8 Small and Isolated Population

Historically pumas occurred throughout the southeastern United States. Habitat loss, declining prey populations, and persecution resulting from European settlement were the primary cause of the decline of pumas in North America, including the Florida panther. Today the panther is only found in south Florida in an area that is less than 5 percent of its historical range (Young and Goldman 1946). This resulted in inbreeding depression of the few remaining panthers and very low population size that led to the decision to list the panther as endangered (USFWS 2008). The few panthers that persisted in the 1980s and early 1990s exhibited some of the lowest levels of genetic variation that had been recorded for wild felids, certainly in comparison to other populations of pumas in western North America (Driscoll et al. 2002). Populations of animals — especially those that persist at low densities such as large carnivores — that are small and isolated from conspecifics invariably begin to be affected by a variety of factors such as altered sex ratios, reproductive declines, and outbreaks of disease. The prevalence of these issues in small populations can often be associated with inbreeding depression, which can result in the expression of deleterious alleles that can contribute to a variety developmental, reproductive and epidemiological problems (Roelke et al. 1993*a*, Roelke et al. 1993*b*). The documentation of many of these factors in panthers during that time period supported the notion that inbreeding depression was having a major impact on the population. Genetic augmentation initiated in 1995 contributed to increasing growth of the panther population in recent years (Hostetler et al. 2013). Recent PVA models (Hostetler et al. 2013 and van de Kerk et al. 2019) confirm that the panther population grew rapidly through 2013 ($\lambda > 1$), but that growth may be slowing (McClintock et al. 2015). This could indicate the heterozygosity initially introduced in the population, the heterozygosity that fueled the growth of the panther population after augmentation in the late 1990s, has peaked in its effects on population growth. Whereas genetic introgression was likely not the sole impetus for the increase in the population size (i.e., wildlife underpasses, land conservation efforts) it most certainly played a major role.

Progress in improving the genetic health of the population may be compounded by further habitat loss, fragmentation, degradation, mortality or a combination of these (Ballou et al. 1989, Johnson et al. 2010). The extent to which these threats may influence genetic health was not analyzed in either PVA. These models assumed current conditions, and these threats were captured in the current vital rate of the panther population. As long as the panther population remains separated from other puma populations (i.e., the nearest puma population is in Texas more than 1500 miles away) the PVAs predict that the population will once again begin to be impacted by a loss of genetic variation due to a variety of factors, including genetic drift resulting in the inevitability that a genetic introgression management initiative will have to be repeated in the future. In all, the most recent analysis of population viability performed by van de Kerk et al. (2019) indicates maintenance of genetic variability in the population will remain a challenge, but that as long as it is addressed with genetic augmentation at recommended intervals a projected population size of 187 adults and subadults should remain viable for the next 50 years if the current conditions (habitat availability, access, genetic health, and prey abundance) remain unchanged. However, we anticipate all these threats will remain or increase due to human population growth and resulting loss, fragmentation, or degradation of their habitat (USFWS Draft 2020).

5.1.7 Tables and Figures

Table 5-1. Percent of the Florida panther's diet by prey type with spatial and temporal components incorporated. The dividing line between north and south is Interstate 75 (Alligator Alley).

Percent Prey Occurrence In Diet	Spatial Occurrence 1977-1989[a]		Spatial Occurrence 1996-2014[b]		Temporal Occurrence (North and South)		
SPECIES	North	South	North	South	1977-1989[a]	1989-2005[b]	1996-2014[b]
Wild hog (*Sus scrofa*)	33.9	8.8	29.01	11.24	42	55.93	21.97
Raccoon (*Procyon lotor*)	9.4	33.9	19.08	28.09	12	27.12	28.03
White-tailed deer (*Odocoileus virginianus*)	11.7	10.8	16.79	29.21	28	5.08	21.97
Nine-banded armadillo (*Dasypus novemcinctus*)	11.9	13.8	13.74	4.49	8	3.39	6.82
Rodentia	7.2	11.7	3.05	6.74	2	0	3.79
Rabbit (*Sylvilagus* spp.)	18.1	20.4	1.53	5.62	4	0	4.55
Livestock	1.7	0	3.05	0	2	6.8	5.3
Other	6.1	0.6	13.75	14.61	2	1.68	7.57

[a] from Maehr et al.1990b
[b] from Caudill et al. 2019

Table 5-2. Relative biomass consumed by the Florida panther with temporal and spatial components included.

Relative Biomass Consumed[c]	Parameters		Temporal			Spatial 1977-1989[a]		Spatial 1996-2014[b]	
SPECIES	Estimated Weight (kg)	Correction Factor[a,c]	1977-1989[a]	1989-2005[b]	1996-2014[b]	North	South	North	South
Wild hog (*Sus scrofa*)	23.0	2.8	117.0	155.8	61.2	94.4	24.5	80.8	31.3
Raccoon (*Procyon lotor*)	5.0	2.2	25.9	58.4	60.4	20.3	73.1	41.1	60.5
White-tailed deer (*Odocoileus virginianus*)	36.0	3.2	90.7	16.5	71.2	37.9	35.0	54.4	94.6
Nine-banded armadillo (*Dasypus ovemcinctus*)	6.0	2.2	17.5	7.4	14.9	26.1	30.2	30.1	9.8
Rodentia	0.1	2.0	4.0	0.0	7.5	14.3	23.2	6.0	13.4
Rabbit (*Sylvilagus* spp.)	1.5	2.0	8.1	0.0	9.2	36.8	41.5	3.1	11.4
Livestock	45.0	3.6	7.1	24.2	18.8	6.0	0.0	10.8	0.0
Other	8.2	2.3	4.5	3.8	17.2	13.8	1.4	31.2	33.1
Total			**270.3**	**262.3**	**243.3**	**235.8**	**227.4**	**226.4**	**221.1**

[a] from Maehr et al.1990b
[b] from Caudill et al. 2019
[c] from Ackerman et al. 1984

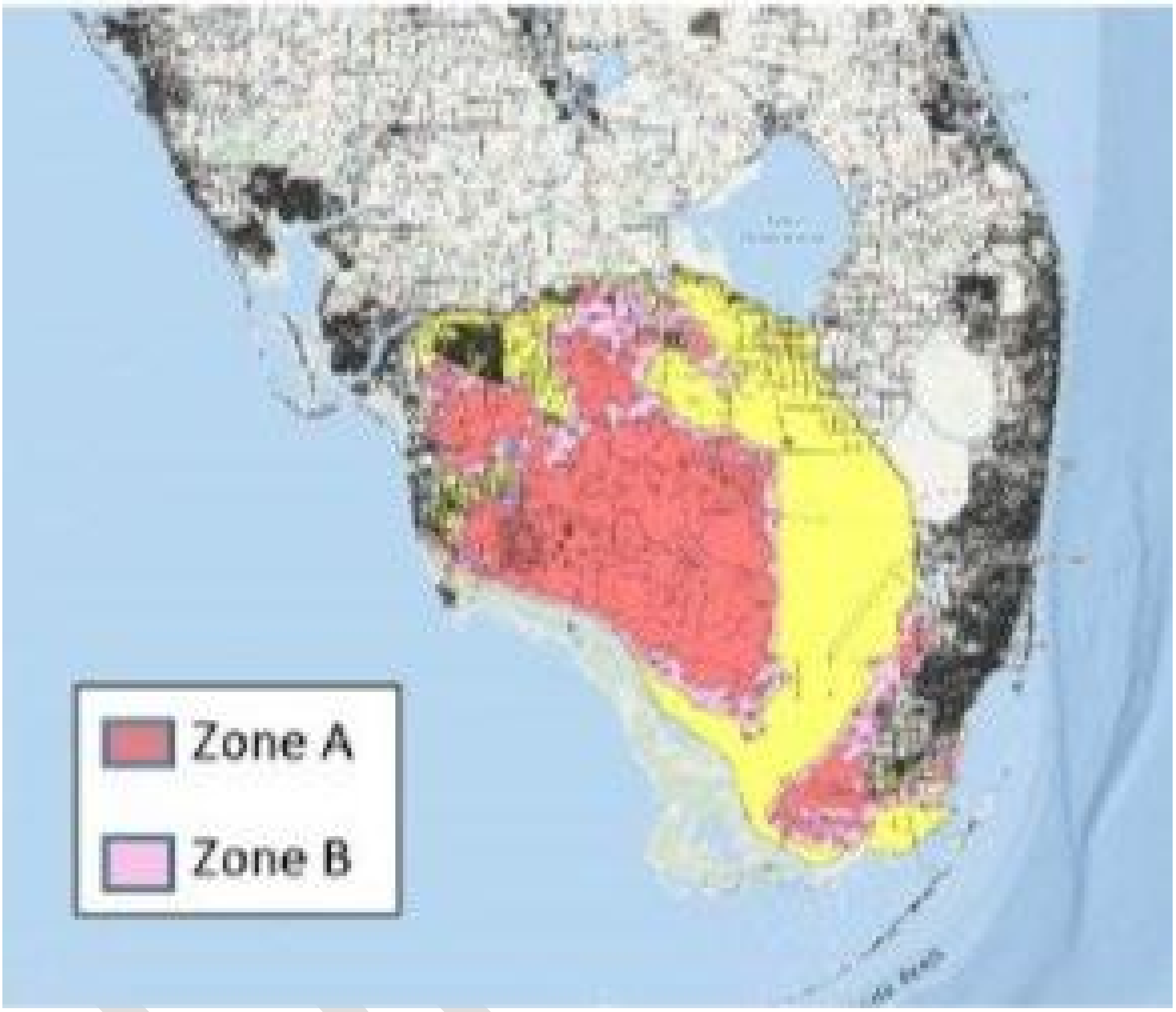


Figure 5-1. Florida panther Functional Zones as defined by the U.S. Fish and Wildlife Service. The yellow indicates Zone C, which is defined as an area occasionally used by Florida panthers and important to dispersal.

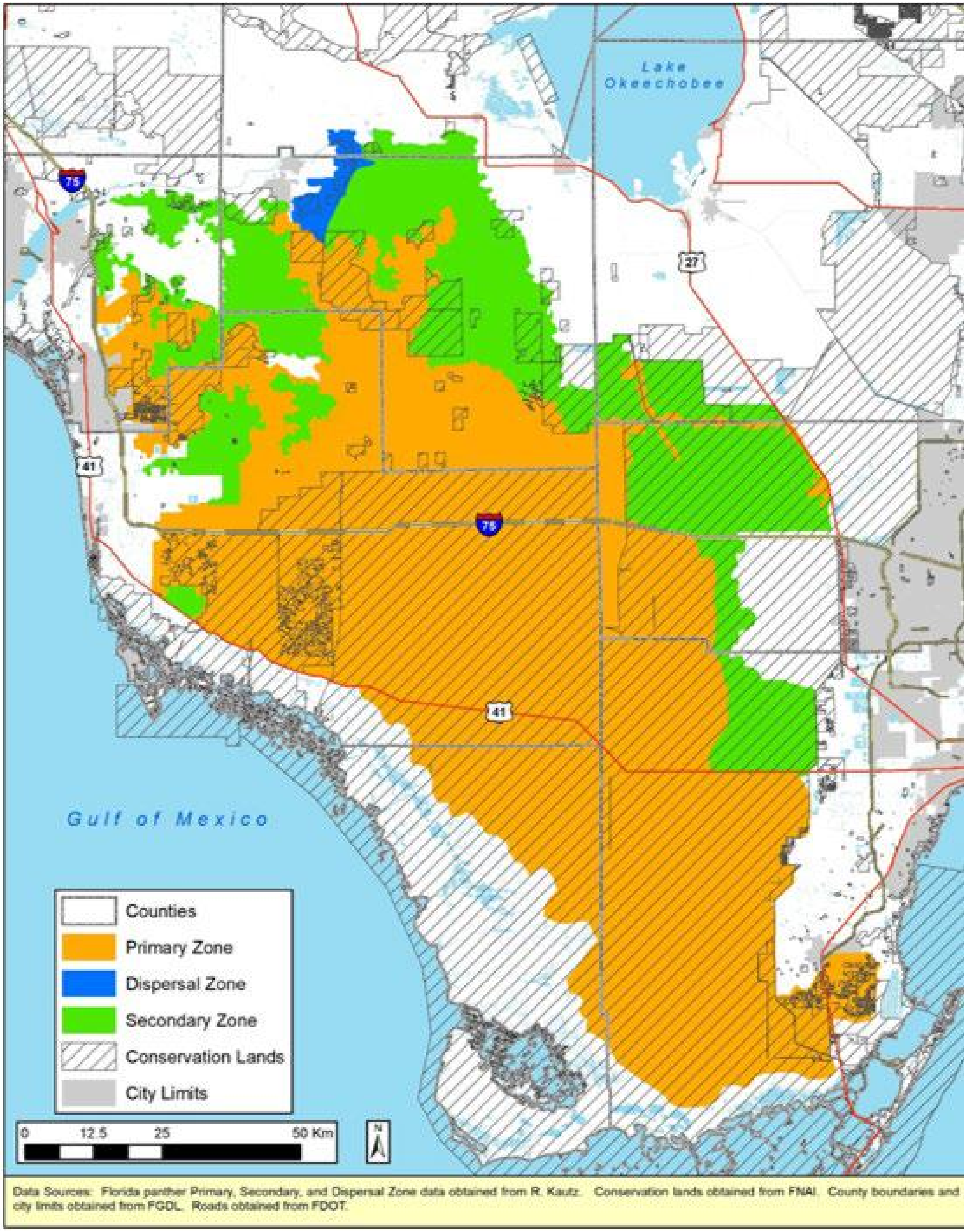


Figure 5-2. Florida panther zones based on Kautz et al. 2006.

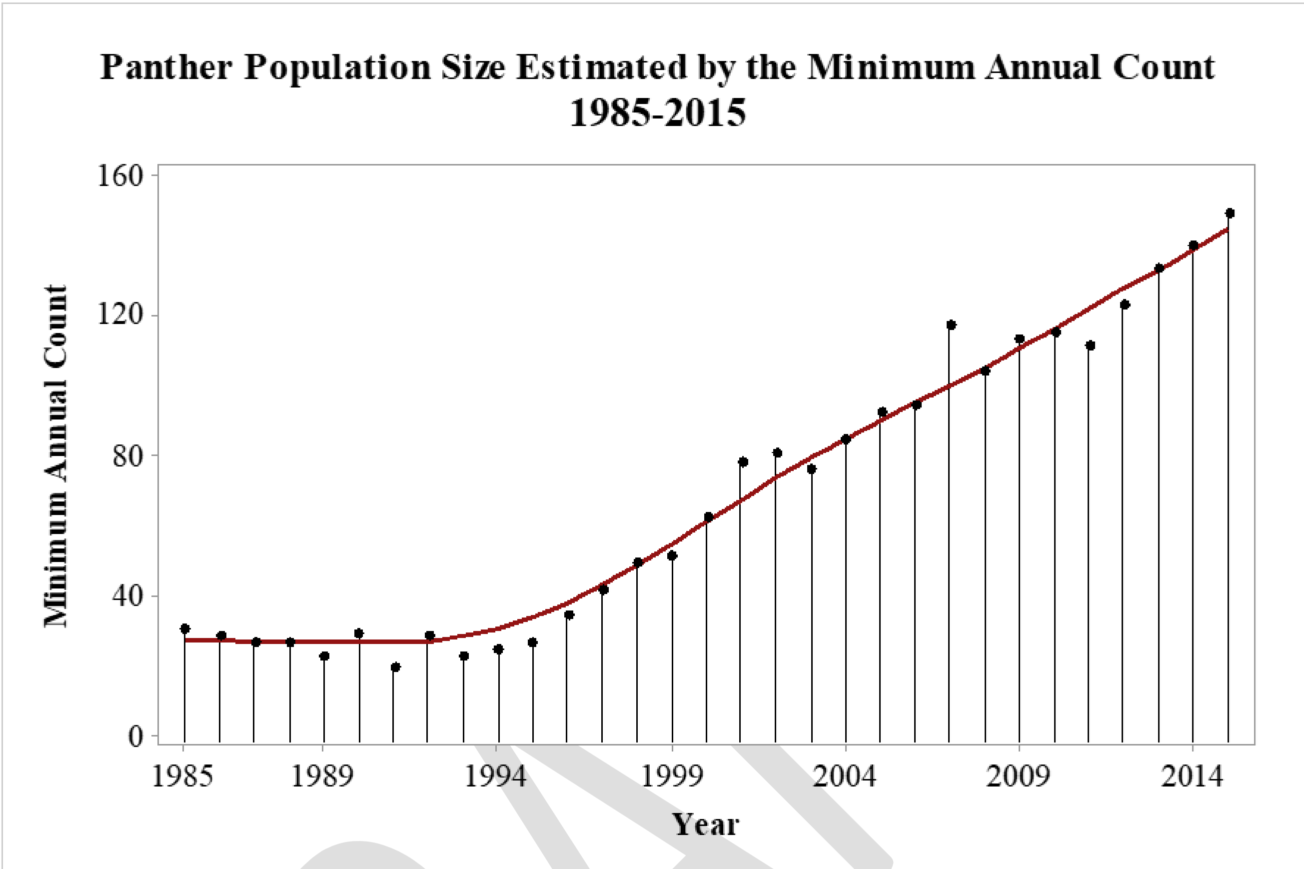


Figure 5-3. Estimated Florida panther population size between 1985 and 2015.

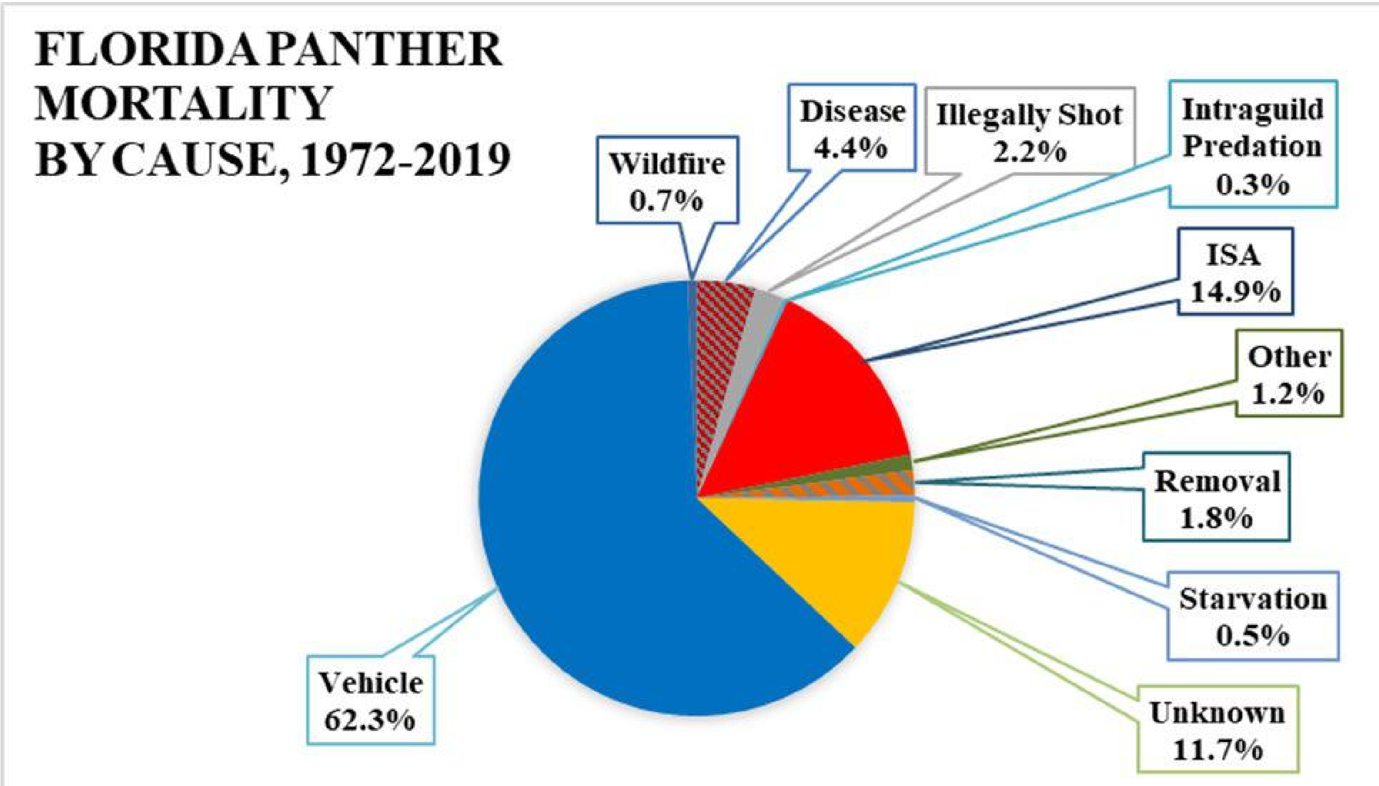


Figure 5-4. Percentage of each cause of Florida panther mortality from 1972 through 2019.

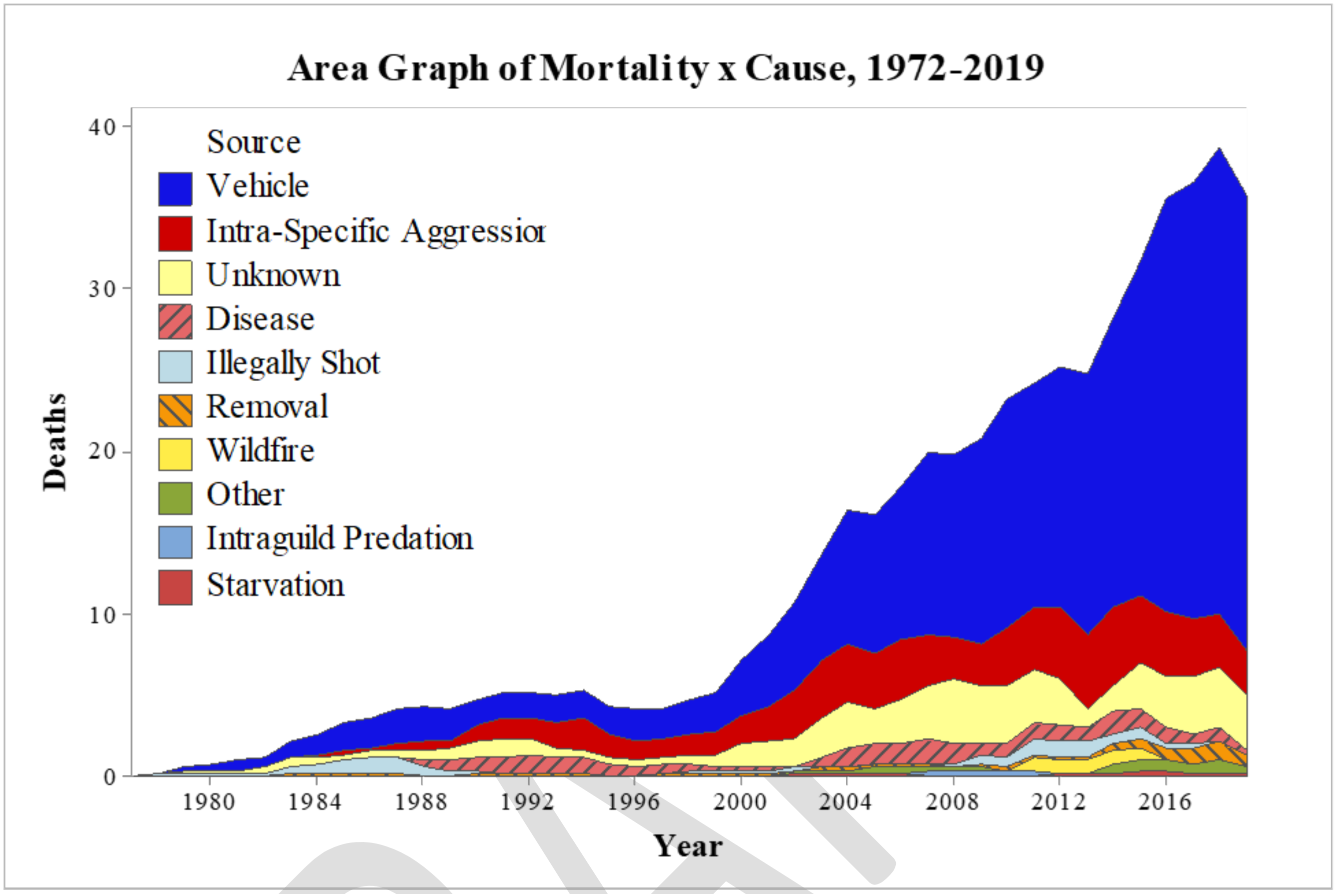


Figure 5-5. Magnitude of each source of Florida panther mortality over time from 1972 through 2019.

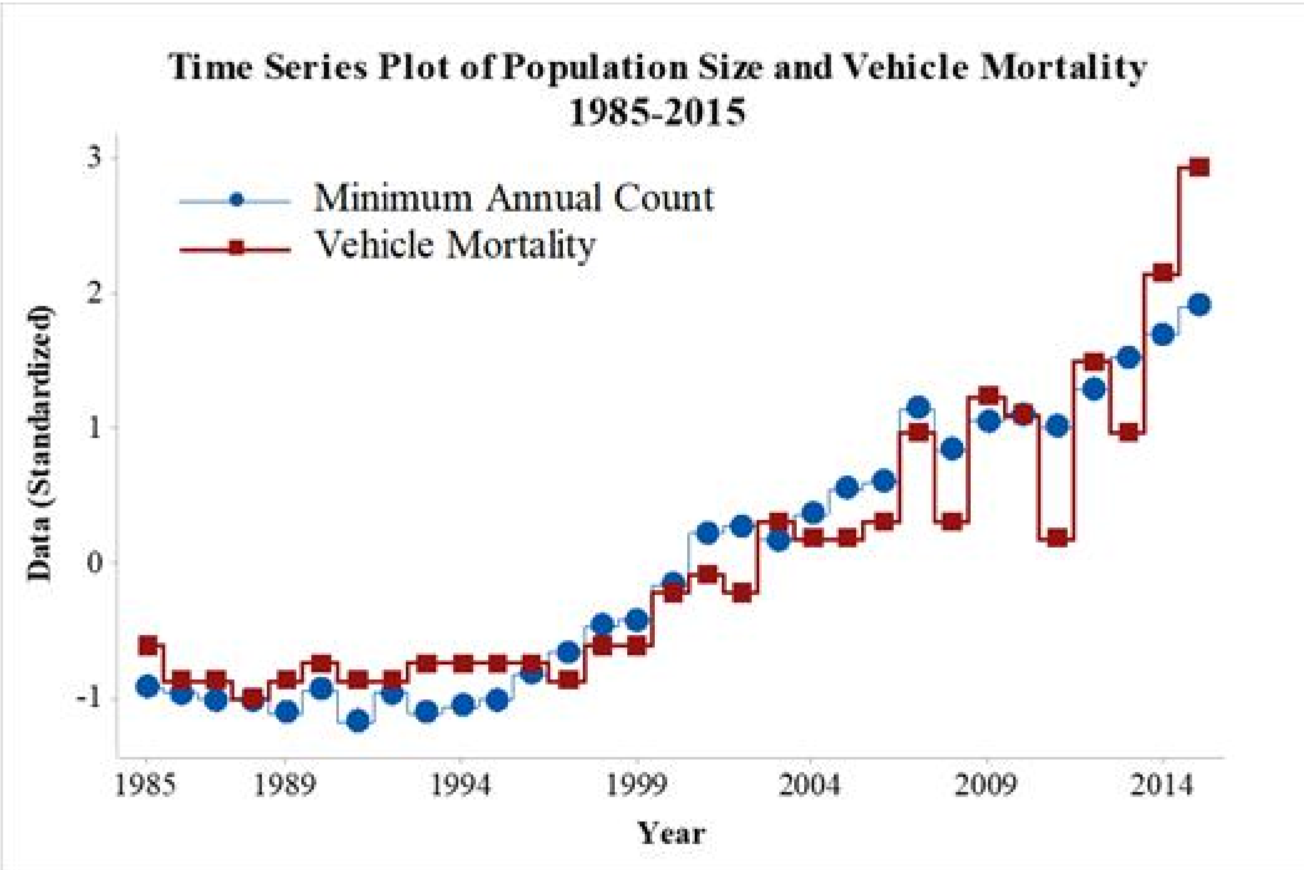


Figure 5-6. Standardized plot of Florida panther minimum annual population counts and motor vehicle mortality over time.

DRAFT

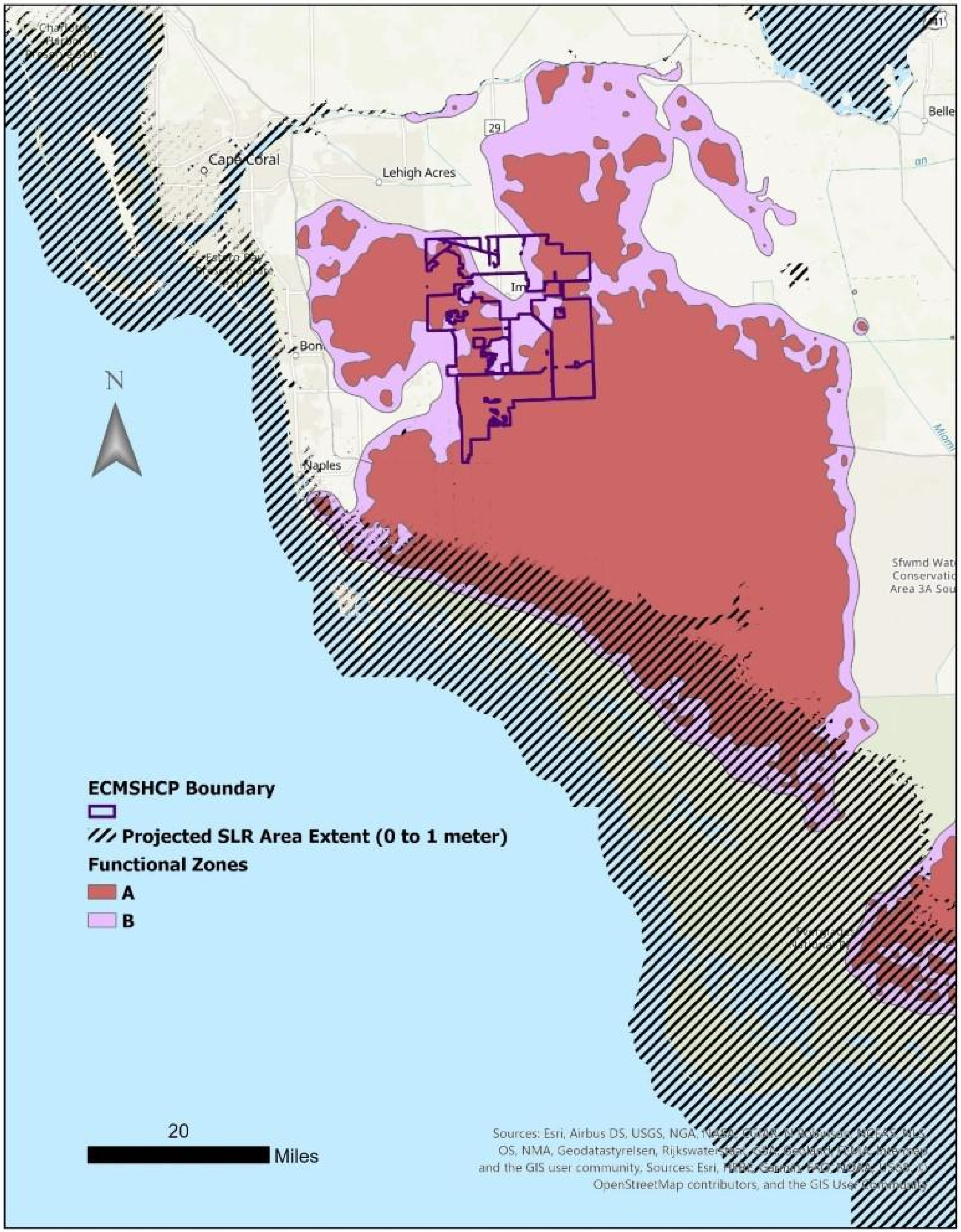


Figure 5-**7.** Inundation of the Panther Functional Zone predicted to occur with sea level rise of 1 meter.

5.2 Environmental Baseline for Florida Panther

This section is an analysis of the effects of past and ongoing human and natural factors leading to the status of the panther, its habitat, and ecosystem within the Action Area. The environmental baseline is a “snapshot” of the species’ health in the Action Area at the time of the consultation and does not include the effects of the Action under review.

5.2.1 Action Area Population Size and Distribution

> **Action Area:** As explained in Section 2 we define the Action Area as the spatial extent of changes in the physical environment that will likely occur because of residential development, commercial development, earth mining, on-going agricultural or recreational activities, and conservation measures proposed in the HCP. Section 3 describes HCP caused changes in traffic volume and infrastructure. The location and density of development, such as the development under the HCP, directly influences the distribution and volume of traffic on existing public roads, as well as the construction of additional lanes to existing roads and entirely new transportation corridors. The distribution and volume of traffic is relevant to this BO/CO, because panther vehicle collisions are a leading cause of panther mortality. To estimate traffic volume, we used the Florida Department of Transportation (FDOT) District 1 Regional Planning Model (Figure 5-8; D1RPM). Using this model, we identified 1,825 miles of roadways within the Action Area where HCP related development is estimated to generate traffic volume increases by 100 trips/day or more by 2040. Thus, in addition to the Plan Area, our Action Area includes 1,825 miles of roadways affected by the HCP (Figure 5-9).

Panthers frequently use the Plan Area and areas immediately adjacent to it for breeding, denning, and rearing of kittens, with portions of the home range of denning females within or near the Plan Area overlapping portions of the Action Area. FWC and Service records indicate: 1 den that produced 3 kittens was located in habitat currently proposed for residential development, commercial development, and earth mining activities in the HCP; and that another 8 females established dens that produced a total of 16 kittens in habitat proposed for preservation in the HCP. Additionally, 13 females established dens that produced 27 kittens within 1 mile of the HCP boundary, and in nearly all cases their home ranges, the home ranges of their offspring, or the paths of their offspring during dispersal overlapped the Action Area (FWC unpublished data).

Panthers also regularly use the Plan Area for other purposes. Specifically, 20,196 records of 181,963 total records (11.1 percent) of documented panther occurrences throughout the range are within the Plan Area (radio-telemetry, GPS, mortality, denning, confirmed observations, and confirmed depredations). 24.9 percent of panthers (62 of 249) monitored by radio telemetry between 1981 and 2018 used areas of the HCP designated for future residential development, commercial development, and earth mining. 36.1 percent (90 of 249) of panthers used areas designated for future preservation in the HCP. Telemetry data from the past 10 years, for individuals that wouldn’t be older than 12 years if still alive, indicates approximately 15 individuals currently or previously monitored by radio telemetry likely still use portions of the Plan Area as a part of their home range, while vehicle mortality data indicates others are young adults that use the Plan Area temporarily during dispersal. Recent research has also found that panther densities in the Plan Area range between 3.9/100km^2 and 4.03/100km^2 (Onorato et al. 2020). Based on the availability of habitat in the Action Area a density-estimated population size estimate ranges between 16.2 and 16.6 panthers utilizing the Plan Area (Table 5-3).

However, more panthers than those tracked by radio telemetry or GPS use habitat in the Plan Area. Uncollared panthers are regularly found among road mortalities in the Plan Area To estimate a more precise number of panthers likely using the Plan Area each year that includes uncollared panthers, as well as collared, we used a combination of telemetry records and mortality records in a mark/recapture method of population size estimation for small population sizes: The Chapman estimator (Chapman, 1951). For the purpose of the estimation we define "marked" as individuals tracked with radio telemetry during the sample period (the calendar year), and treated those that were not tracked as "unmarked." We also assumed another individual quickly replaced panthers killed within the Plan Area, and that panthers that left the Plan Area were replaced by individuals entering the Plan Area (meaning rates of birth, death, immigration, and emigration did not change the annual population size of the Plan Area). To confirm that we selected the correct statistical method for the data we had available, and used the estimator correctly, we had our analysis peer reviewed by a statistician (Ross 2020a).

Using this method, we estimate an average of 27.6 ±5.81 adult panthers (residents inhabiting home ranges plus transient individuals) used the Plan Area, annually, in the past five years (Table 5-3, Figure 5-10). These individuals likely exploit the Plan Area because it is rich in prey, it is centrally located relative to the panther's range, it is frequently used by females for denning, and is an area through which many young panthers disperse from their natal home range.

Chapman's population size estimation for small populations:

$$Nc = \frac{(K+1)(n+1)}{k+1} - 1$$

where,

N_c = Number of animals estimated in the population
n = Number of animals marked on the first visit
K = Number of animals captured on the second visit
k = Number of recaptured animals that were marked

or more precisely,

N_c = Number of panthers likely using the Plan Area in any given year
n = Number of telemetered animals that visited the Plan Area in a given year
K = Number panthers killed by vehicle collision that year
k = Number of panthers killed by vehicle collision that year that were monitored by radio telemetry

5.2.2 Action Area Conservation Needs and Threats

Panthers in the Action Area face the same threats as those listed range wide. Specifically, panthers in the Action Area face impacts from human disturbance, and human-caused habitat loss, fragmentation, and degradation from residential development, commercial development, and climate change. Sources of human-caused mortality in the Action Area, such as collision with motor vehicles, illegal shootings, and increased exposures of panthers to disease and pollution also threaten growth of the panther population. Additionally, as the human and panther population both grow incidences of human-panther conflict may also occur to the detriment of panthers. Lastly, panthers confront many ecological challenges, such as genetic risks associated with small population size or declines in prey populations caused by natural processes or human activity.

Among human sources of threats to panthers, vehicle collisions account for the largest single cause of injury or death. Range wide, vehicle strikes have been responsible for 60 percent of the panther deaths documented from 1972 to 2018, with 22.4 percent of all documented vehicle mortalities having occurred on roadways in the Action Area. In the past 5 years an average of 22 panther panthers were killed in vehicle collisions annually in the Action Area, while 5.6±0.51 of these 22 panthers are killed by motor vehicle collision on roadways within and immediately adjacent to the Plan Area.

Other human sources of mortality, such as illegal shootings, exposure to disease, and exposure to contaminants have also been documented in the Plan Area and areas immediately adjacent to either, though the frequency with which they occur and their individual influence on the overall population trajectory is difficult to determine.

Some aspects of human activity in the Action Area also serve as attractants that increase the local abundance of panthers over time (FWC, unpublished data) but with detrimental effects to the panther. These include the introduction of pets, livestock, and feeders that attract prey preferred by the panther or act as targets of panther depredation. Where prey and panthers concentrate near areas of human development, the risk of human/panther conflict, interspecific aggression, disease, panther mortality from vehicle collisions or illegal shootings, and management removal increases.

Lastly, habitat loss and fragmentation has already occurred with the Action Area, such as through the construction and use of roads, conversion of former forest lands to agricultural use in the last century, and via the construction of the Ave Maria residential community and other smaller-scale residences.

In total, we believe the demographic impact of these threats to baseline panther survival, reproduction, and population size, as well as the impacts of genetic erosion due to inbreeding in the Action Area, were captured in the estimation of survivorship and fecundity performed by van de Kerk et al. (2019).

Because these threats are known and well understood, actions to minimize, offset, or reverse their impact on panther population viability constitute the conservation needs of the species in the Action Area. Many ongoing collaborative conservation actions by federal, state, and private partners have long since been established to address them. For example, these parties have substantially increased areas of habitat protected and managed to the benefit of the species since its listing, and facilitated the construction of numerous wildlife crossings that have reduced panther mortality at many locations. The ECMSHCP also contains measure to avoid or offset impacts to panthers, and conservation measures designed to assist recovery. Many of these measures are difficult to assess quantitatively, but they are described qualitatively throughout this assessment and are included in our jeopardy analysis.

As habitat loss continues and sources of mortality, such as vehicle collision, increase alongside human population growth, more habitat will need to be preserved and panther-vehicle collisions reduced for the eventual recovery of the Florida panther. Because cattle ranches contain a substantial amount of the remaining suitable habitat within the panther's range partnerships between traditional partners with regional ranching operations are likely to play a growing role in panther conservation and recovery going forward (Pienaar et al. 2015).

Both the RLSA and the ECMSHCP target areas for conservation, including important wildlife linkages. The HCP includes Camp Keais Strand and the Okaloacoochee Slough as part of the Preservation areas, and would permanently protect these linkages through conservation easements. This commitment provides greater assurance that these wildlife linkages will be protected than the voluntary RLSA program. The type of landscape planning in the HCP also controls where habitat fragmentation occurs, directing it away from these important habitat linkages.

In section 5.1.6., we explained that about 63 percent of the Functional Zone is in conservation. However, within the Action Area there are no lands currently in conservation. As mentioned in section 5.1.6., as much as 25 percent of future development projects could occur without consultation or technical assistance from the Service, and may not include minimization or conservation measures for the panther. Because of this HCP, we will consult on all development in the Plan Area. The rest of the Action Area (*i.e.,* the Plan Area and select roads outside of the Plan Area) consists of roads on which we will likely consult. Therefore, the HCP is expected to increase the number of projects that will consult or receive technical assistance from the Service, and likely increases minimization and conservation measures that are implemented in the Action Area.

As discussed in section 5.1.6.4, it is difficult to attribute specific additions to traffic volume to all parties responsible for the additions. Because we recognize that multiple entities are responsible for increased traffic volumes that lead to increased risk of panther vehicle mortality, we also believe that the solution will involve multiple partners working together to implement solutions. A total of 60 underpasses have been built in the Action Area, and more are anticipated to be constructed as a result of this HCP and the efforts of local, state, and Federal agencies. Underpasses implemented as a result of this HCP will not only reduce vehicle mortality associated with HCP-related increases in traffic volumes, but also those associated with other sources of increasing traffic volumes. See section 15.4.2 (Cumulative Effects) for our analysis.

5.2.2.1 Habitat Loss

Habitat loss within the Action Area is a significant threat to panthers that use it. The importance of various habitat types to panthers is summarized in 5.1.3, but in general, the habitat of the Florida panther is an extensive landscape of natural, semi-natural, and agricultural lands. Forested habitats are selected by and of vital importance to panthers in South Florida. These cover types provide the most important habitat for panthers to meet life cycle requirements that include selection of den sites, daytime-rest sites, and cover for hunting prey (Belden et al. 1988, Maehr and Caddick 1995, Comiskey et al. 2002, Cox et al. 2006, Kautz et al. 2006, Land et al. 2008, Onorato et al. 2011). Panthers utilize forest habitat patches of any size (Kautz et al. 2006, Onorato et al. 2011).

Other natural habitats are also selected by panthers, but to a lesser extent than forests and usually when they are close to forest cover. Agricultural lands (e.g., croplands, improved pasture, and citrus groves) are used in proportion to availability (Onorato et al. 2010). GPS-telemetry records collected across the diel-period revealed that panthers occur in forest cover 59 percent of the time and in open habitats 41 percent of the time (Onorato et al. 2010). Although panthers may be found at distances of >1000 m from forest patches, 74 percent and 85 percent of GPS-telemetry records were located within 100 m and 200 m, respectively, of forest cover (Onorato et al. 2010). White-tailed deer and wild hogs, the primary prey of panthers, would be expected to use more open cover types such as pasturelands and other agricultural lands adjacent to forest cover due to the plentiful food sources in these habitats. An analysis of panther locations in the Plan Area showed that most panther telemetry locations in agricultural areas were within 300 m of forested areas. Our own review found 95.7 percent of all panther records occur within a forest cover type or within 300 m of one. This is within the distance cited by Onorato et al. (2010). The forested areas along with the 300 m buffered area are defined as preferred panther habitat for the remainder of our analysis.

Under the present configuration of the HCP the Plan Area contains 77,063 acres (311.9 km^2) of lands currently used for agriculture (Tables 2-1 and 2-2). The amount of agricultural land that panthers use differs based on types of agriculture (*e.g.,* ranchland is used more than row crops). Irrespective of the value of these lands, all their value to panthers is lost when they, or the forest edges within 300 m of them, are converted from their present land use to urban and exurban development. Because of their location and relatively lower value to panthers and other wildlife, to minimize the effects of the action, the HCP proposes to primarily target agricultural areas beyond 300 m of forest edges for their proposed developments and other covered activities.

The Service acknowledges that future development in eastern Collier County is probable, and that any form of development will have some effect on panthers. Development in this area can happen under a variety of scenarios, including this HCP. Development and activities as proposed in the HCP will result in the loss of habitat otherwise suitable for panthers and used by them in the following way. Of the 156,763.7 acres (634.4 km^2) of the Functional Zone within the Plan Area, 42,544 acres (172.2 km^2) are forest cover surrounded by 59,808 acres (242.0 km^2) of other habitats within 300 m of forest cover. Based on recent density estimates (3.9 panthers/100 km^2 (1 panther per 6,336 acres) and 4.03 panthers/100 km^2 (1 panther per 6,178 acres))within the Plan Area and telemetry records mentioned previously, we estimate between 9 and 16.6 panther home ranges can be supported within these 102,352 acres (414.2 km^2) of preferred panther habitat, with the higher end of that range being most likely. (Table 5-3).

As mentioned previously, though, using the Chapman estimator determined an average of 27.6 ±5.81 panthers visited the Plan Area each year for the past 5 years (Table 5-3, Figure 5-8). We believe the discrepancy, the difference between the Chapman estimated number of panthers actually using the Plan Area annually and the 9 - 16.6 home ranges the Plan Area can support, is explained by panthers which only use the Plan Area for short periods of time, such as during dispersal. A closer look at panther/vehicle collision records finds many killed on roadways within the Plan Area are uncollared, young adults of dispersal age.

Therefore, for this analysis, based on our estimates in Section 5.2.1 and records documenting past panther presence in the Action Area we accept the following as reasonable estimate of annual use: on average 27 panthers use the Plan Area each year, and of these, a maximum of 17 likely rely on resources within the Plan Area as part of their home range, while 10 others likely use the Plan Area for dispersal or other short-term uses. If 27 panthers use the Plan Area each year, that would mean, on average, between 23 and 12 percent of the panther population (assuming a population size of 120 or 230 adults, respectively) use habitats in the Plan Area for feeding, sheltering, denning, or dispersal each year. If 17 panthers use the Plan Area as a portion of their home range, that would mean, on average, between 14.2 and 7.4 percent of the panther population use habitat in the Plan Area for that purpose.

Panther Review Team Analysis: In 2008 the Panther Review Team (PRT), composed of six scientists with expertise in Florida panther ecology and landscape- level natural resource planning, was commissioned by the Florida Panther Protection Program, a partnership of landowners/ITP-Applicants and non-governmental environmental organizations (PRT 2009). The PRT Analysis benefits our understanding of the threat of habitat loss in the Plan Area by analyzing several scenarios of development within the Rural Lands Stewardship Area (RLSA) the HCP proposes development in. Specifically, the Florida Panther Protection Program requested the PRT assess the impact of landowner proposals for development in the RLSA. The PRT analyzed the effects of habitat loss using the previously recommended Service methodology for assessing impacts to panther habitat from development. A summary of this analysis and its results can be found in Appendix E. The PRT report can also be found in the literature cited for this B.O.

5.2.2.2 Habitat Fragmentation

The growth of the human population and construction of roads are current sources of habitat fragmentation in the Action Area. The South Florida RFP model (Frakes et al. 2015) showed high road density to be a strong negative indicator of present habitat suitability for panthers due to the fragmentation of the landscape and the increased risk of vehicle collisions (discussed in detail in 5.2.2.7). Additional habitat fragmentation has the potential to separate/isolate habitat patches by great enough distances to the point where panthers will be unlikely to travel between them (Lindenmayer and Fischer 2006). Specifically, the Action Area contains areas of important corridors and habitat linkages necessary for the movement of panthers from their existing range to the Caloosahatchee River and beyond. Much of these have already been impacted by the conversion of native habitats to agricultural use and may be further impacted by conversion of these to development. Additionally, panthers have been and will likely continue to be deterred from crossing roadways because of increasing traffic. Panthers also have, and will continue to be, less likely to successfully cross roadways where municipal and state improvements add lanes, increase traffic speeds, and attract existing sources of traffic volume to areas of high panther use.

To mitigate the impact of these, wildlife underpasses have been built to restore the functionality of these habitat linkages where they've been bisected by roadways, roadway improvements, and increasing traffic volume. Future road construction that bisects existing habitat blocks, corridors, and linkages, or traffic volumes that increase the barrier effect of existing roads, will likely require similar and additional measures to minimize the impact of present and future habitat fragmentation. At present, the Applicants for the ECMSHCP have committed $12.5 million towards the construction of new wildlife crossings in key locations (which may be inside or outside of the HCP footprint depending on the greatest need and opportunity for installation) and indicated more may be available for the construction of wildlife crossings in the future through their administration of the Marinelli Fund. The crossing will not only offset traffic expected from HCP related development, but from other sources as well. A currently unquantifiable benefit of the HCPs is that if a crossing is proposed on HCP covered lands, we can work with ECPO landowners to ensure that habitat for panthers is maintained in perpetuity on both sides of the road, and adequate fencing and gating is installed and maintained. These features will increase crossing effectiveness and enhance wildlife corridor functionality that will be greater than what is currently estimated in the PVA. Although this coordination would be possible without the HCP, it would be probable with the HCP in place.

Additionally, the Applicants' HCP establishes the intent to locate new commercial development, residential development, and earth mining activities away from these habitat corridors and linkages, and to retain at least 95 percent of current land use within them through the establishment of conservation easements.

Panther Review Team Analysis: The PRT analyzed the effect of landowner proposed development and traffic generation on landscape connectivity. A summary of their analysis and findings can be found in Appendix F. The PRT report is also included in the literature cited for preparation of this B.O.

5.2.2.3 Habitat Degradation

The legacy of habitat degradation and loss throughout the range of the species draws special attention to the value of remaining areas of habitat in the Plan Area. Much of the habitat most preferred by panthers is concentrated in areas designated for preservation in the HCP. Though these areas are not designated for development in the Rural Lands Stewardship program (which designates these areas as FSAs, HSAs, and WRAs), or by the Applicants, they nonetheless remain at risk of degradation through the secondary effects of new development located adjacent to them, the proliferation of invasive species, and climate change. We summarize the effect of habitat degradation on panthers and prey species below while both are discussed in more detail in Section 5.1.6.3.1.

<u>Decline in Prey Abundance</u>

At all phases of development (clearing, construction, use, and maintenance) human activities produce noise, dust, and smoke, and these can penetrate panther habitat by as much as 300 to 1,000 meters (HCP), depending on the source. As an ongoing activity within the Action Area, these disturbances likely cause panthers or their prey to avoid areas where these are occurring, or to use them differently (e.g. changing the time of day they use these areas). Increase in construction and human occupancy in the future will likely sustain these effects on adjacent areas of otherwise suitable habitat for long periods of time.

When these disturbances occur, they may result in changes in prey abundance, community composition, and exposure to disease, invasive species, and domestic species maintained by residents. The presence of human development may also affect habitat management activities which benefit the panther's prey, specifically through increased restrictions on prescribed burning by agencies and the necessity of agencies to suppress naturally occurring wildfires whenever property is threatened.

<u>Environmental Contaminants</u>

Environmental contaminants may also originate in new areas of residential and commercial development and enter the panther's food chain, affecting panthers beyond the WUI, thereby degrading the value of habitats closer to areas of new development. Environmental contaminants have not been documented as the ultimate cause of death in a panther. However, it is likely that contamination with one or more environmental toxins could cause subclinical health effects and when combined with other stressors (environmental or physical), may reduce fitness and reproductive performance and increase susceptibility to disease. Ongoing research into the effects of environmental contaminants in panthers is required as the subtle long-term effects of exposure to environmental contaminants is often challenging to prove until population declines occur (World Health Organization and United Nations and Environment Programme 2013). FWC continues to monitor these contaminants.

Eight of seventeen panthers necropsied after deaths from other causes in the Action Area, and analyzed post-mortem, showed detectable amounts of Organochlorines in abdominal fat. Two had detectable amounts of PCB in abdominal fat, and 2 had detectable levels of anticoagulant rodenticide in their liver. Increasing human presence in the Action Area can increase incidences of disease and contaminant exposure affecting panthers and their prey.

Lastly, human activities such as hunting can increase the exposure of panthers and other species to lead via the consumption of wounded prey. There has been at least one case documented in the U.S. of a *Puma concolor* dying of lead toxicosis after consuming prey that had been previously shot by hunters (Burco et al. 2012).

All these effects, alone or in concert with other threats, could diminish the value of habitats to panthers within the WUI without altering the vegetative structure or other ecological features of the habitat.

5.2.2.4 Motor Vehicle Mortality

Vehicle collisions are a significant source of mortality and directly impact the panther population through reduction in panther numbers and potential for population expansion. Vehicle strikes have been responsible for 60 percent of the panther deaths documented from 1972 to 2018. 17.9

percent (103 of 547) of panther injuries and mortalities from all causes occurred in the Action Area. Of these, 82 were killed by collision with motor vehicles while 1 was injured. These 83 individuals represent 22.4 percent of all panthers documented as injured or killed by vehicle collision range wide. Motor vehicle mortality took an average of 22 panther mortalities/year in the Action Area, over the past 5 years, and an average of 5.6±0.51 per year within the Plan Area (Figure 5-11), proper. As mentioned in Section 5.1.6.4, 60 percent of mortalities by vehicle collision are male and 40 percent are female.

Wildlife underpasses to reduce panther vehicle collisions were first constructed in South Florida beginning in 1985 and 1986. These crossings successfully allow for the safe movement of panthers and prey, including white-tailed deer and raccoons beneath busy roadways (Foster and Humphrey 1995, Land and Lotz 1996). Based on demonstrated use of wildlife crossings by panthers and prey60 wildlife crossings or bridges have been modified for use by panthers on Florida's roads (FWC 2020b) to facilitate safe passage of panthers that must cross roadways to reach portions of their home range, or who are in search of new home ranges during dispersal. However, roadway mortalities continue and FWC, the Service, and stakeholders have identified additional locations where panthers and other wildlife would benefit from the installation of additional wildlife crossings and wing fencing.

5.2.2.5 Illegal Shooting

Injury due to gunshot is not an uncommon finding in panthers and may result in immediate death or may be found at necropsy following the death due to other causes. Three panthers with gunshot wounds were found in the Rural Lands Stewardship Area, and we assume these individuals were shot in the RLSA or nearby. One panther survived a gunshot wound to the head and evidence of the gunshot was discovered during necropsy after the animal died from collision with a motor vehicle. Another panther died as a result of the gunshot (FWC unpublished data). A third panther was found shot within the Plan Area and later housed at the Naples Zoo. Human and panther population growth in the Action Area may increase the risk of illegal shootings, however, we do not have a way to estimate an increase and assume that current vital rates capture the majority of this threat in our modeling.

5.2.2.6 Disease

Disease prevalence is a fluid process dependent on host (panther) susceptibility (e.g., genetics, health, population density, etc.) pathogen characteristics (virulence, etc.), and environmental conditions (e.g., contaminants, hydrology, prey availability, etc.). As these factors shift, the risk of new epizootics (*e.g.,* FeLV) and potentially catastrophic population effects can increase. As such, continual disease monitoring will be critical to track and identify known and emerging threats to the panther population.

Two panthers have been documented to die from disease within the Rural Lands Stewardship Area, representing approximately 8.7 percent of all panthers known to have died of disease, range wide (FWC unpublished data). Several environmental contaminants, namely mercury, poly-chlorinated biphenols (PCB) and dichlorodiphenyldichloroethylene (DDE), have been documented in panther tissue and continue to be a potential threat to panther health and survivability (Facemire et al. 1995). These contaminants bioaccumulate in the aquatic food chain and reach most elevated concentrations in the upper trophic levels. Levels of these contaminants in panther tissues have fluctuated over the years of sampling, likely representing both ecological shifts that lead to variable contaminant levels in prey species, as well as changes in prey species selected by panthers.

Four panthers died from unknown causes within the Plan Area (5.8 percent of all panthers to die from unknown cause). We do not have a way to estimate future projections of panthers which may die from unknown causes, but we assume they are captured in the vital rates reported by van de Kerk et al. (2019).

5.2.2.7 Climate Change

Panthers, their prey, and their habitat are all at risk of impacts from climate change in south Florida. These include but are not limited to sea level rise and inundation of habitat, habitat degradation, mortality from extreme weather events, and vector-borne disease. Climate change will undoubtedly affect precipitation and temperature in the Action Area, likely altering vegetative community composition over time as well as seasonal water levels. We treat Sea Level Rise up to 2070 as an effect in the baseline portion of our assessment as it will have range-wide effects on demographic parameters and habitat availability for panthers within the proposed permit duration of the HCP. Sea Level Rise of 1m will affect the panther's range and roadways at the southernmost points of the Action Area, but the Plan Area isn't expected to be inundated by 2070.

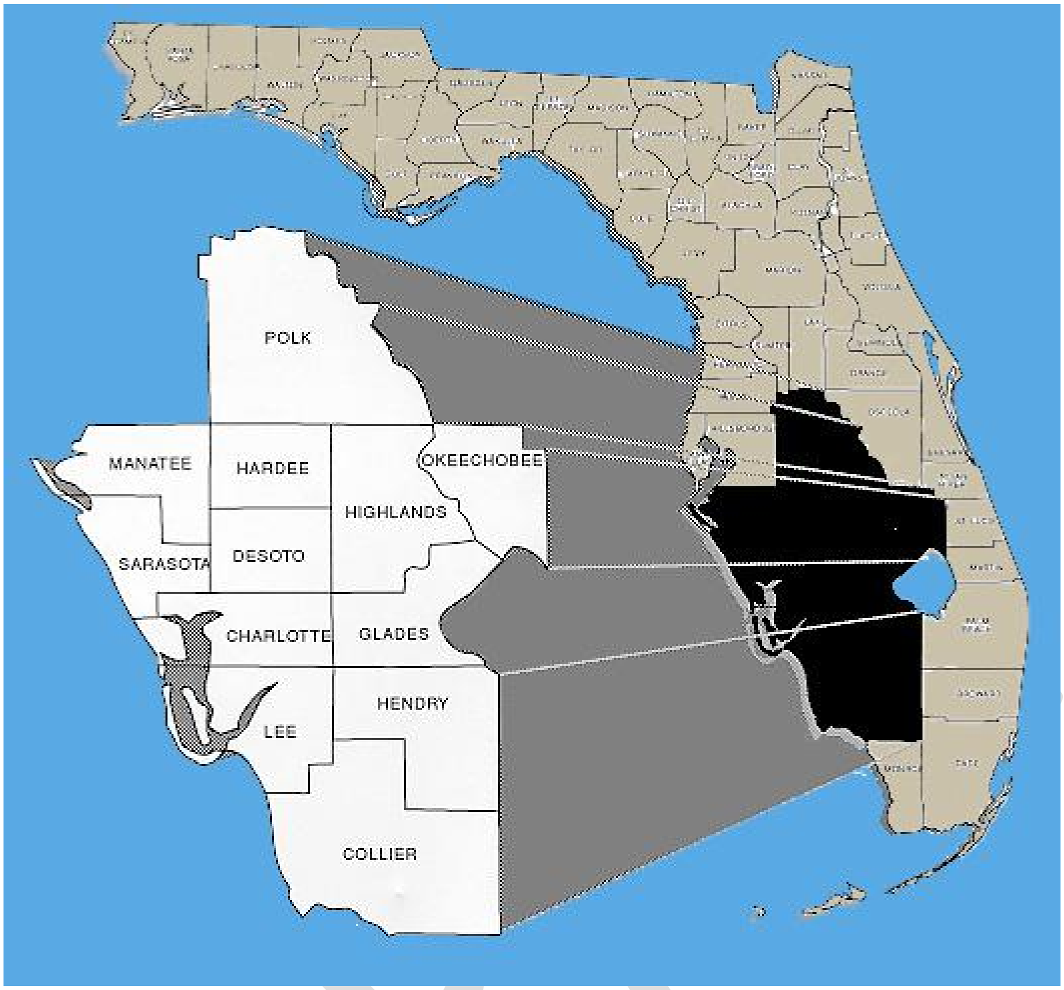
5.2.2.8 Small and Isolated Population

Since state and federal laws afforded them legal protections, panther numbers slowly increased until genetic restoration efforts improved population health thereby allowing a rapid growth of the population. The current panther population, at least 5-fold larger in size when compared with the population 3 decades ago, has greater resiliency today than it has exhibited for likely well over 100 years. Despite these achievements, the population is still small, and models predict that it remains at risk from genetic introgression into the future (van de Kerk et al. 2019). Results from the two most recent PVA models (Hostetler et al. 2013, van de Kirk et al. 2019) reveal that the south Florida panther population is viable for the next 100 years assuming current conditions. However, these PVA models did not take into account large-scale habitat loss or other detrimental anthropogenic activities.

5.2.3 Tables and Figures

Table 5-3. Observations and estimates of Florida panther use of the HCP Plan Area and Action Area Roads within the RLSA. The advantage of the Chapman's Estimate is that it estimates the abundance of panthers that weren't tracked with radio telemetry or killed in motor vehicle collisions that still used the HCP Plan Area in recent years.

N	Sum	Mean (SE)
Chapman's Estimate (2014-2019)	N/A	27.6 ±5.81
Density Estimate	N/A	16.4±0.20
Observed w/ Radio Telemetry (1982-2018)	97	7.9±0.65
Documented Mortality (1980-2018)	74	5.2±0.34
Dens (1996-Present)	9	N/A
Kittens (1996-Present)	19	2.11±.26



https://www.fdot.gov/publications/distmap/d1map.shtm

Figure 5-8. Counties covered in the Florida Department of Transportation's District 1 transportation model.

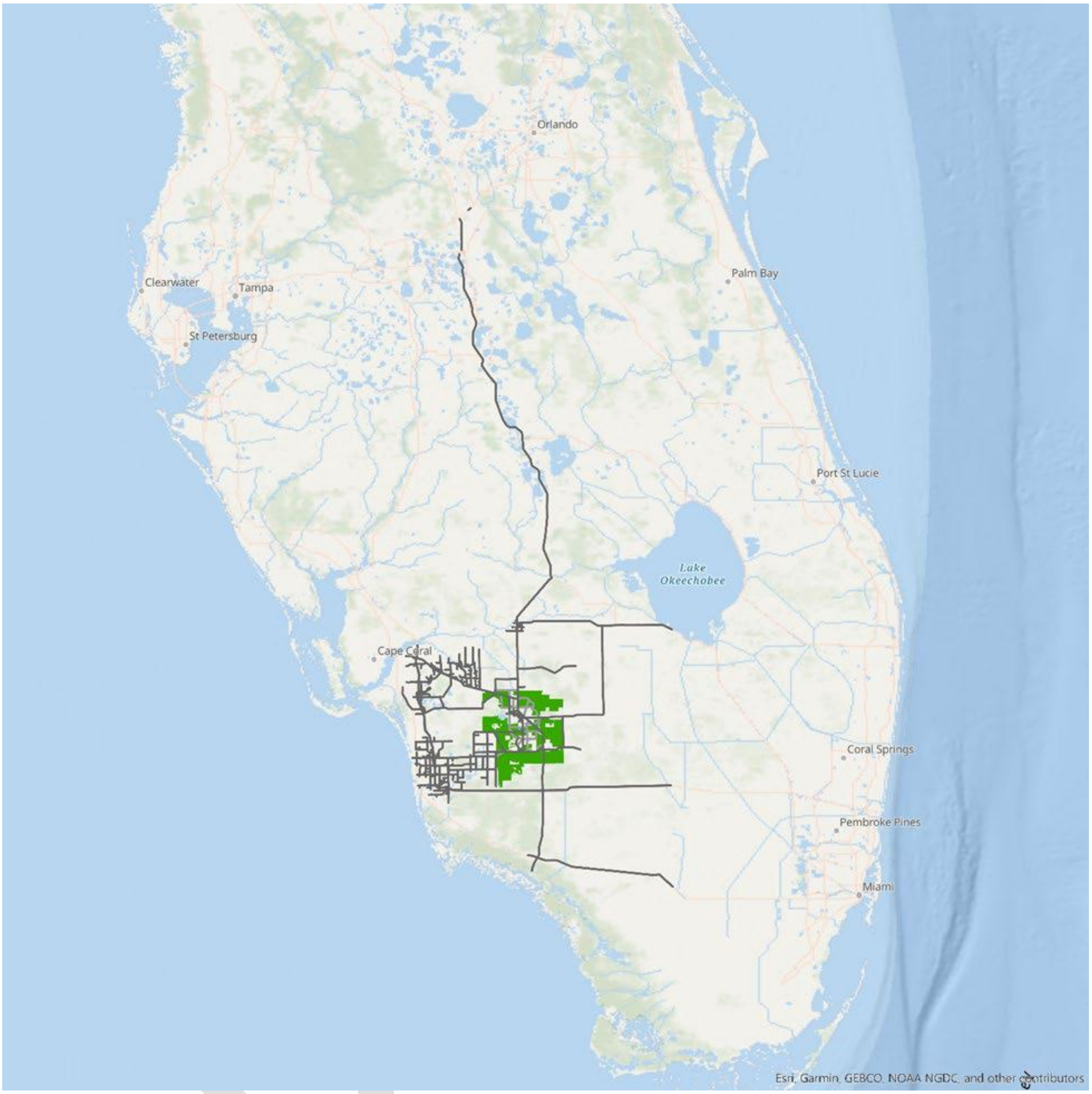


Figure 5-9. Extent of the Action Area for this consultation, which includes:

1) the 159,489-acre Plan Area (green); and
2) 5,072 discrete road segments through and extending beyond the Plan Area (black). Together the road segments equal 1,825 miles.

Population Size Estimate of the Plan Area

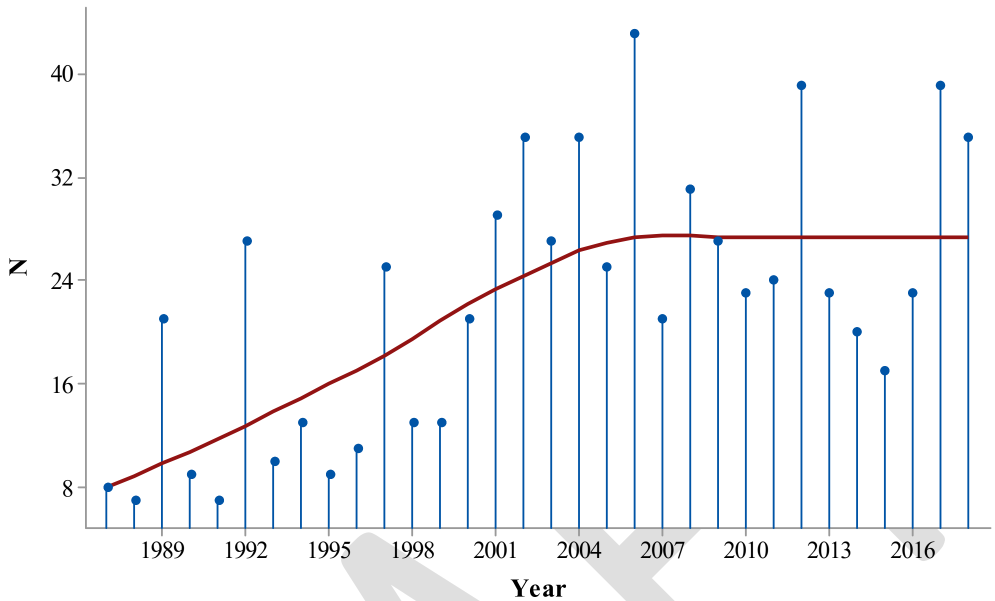


Figure 5-10. Population size estimate of Florida Panthers using the Plan Area of the Eastern Collier Multiple-species Habitat Conservation Plan.

Panther/Vehicle Collisions (PVM) in the Action Area

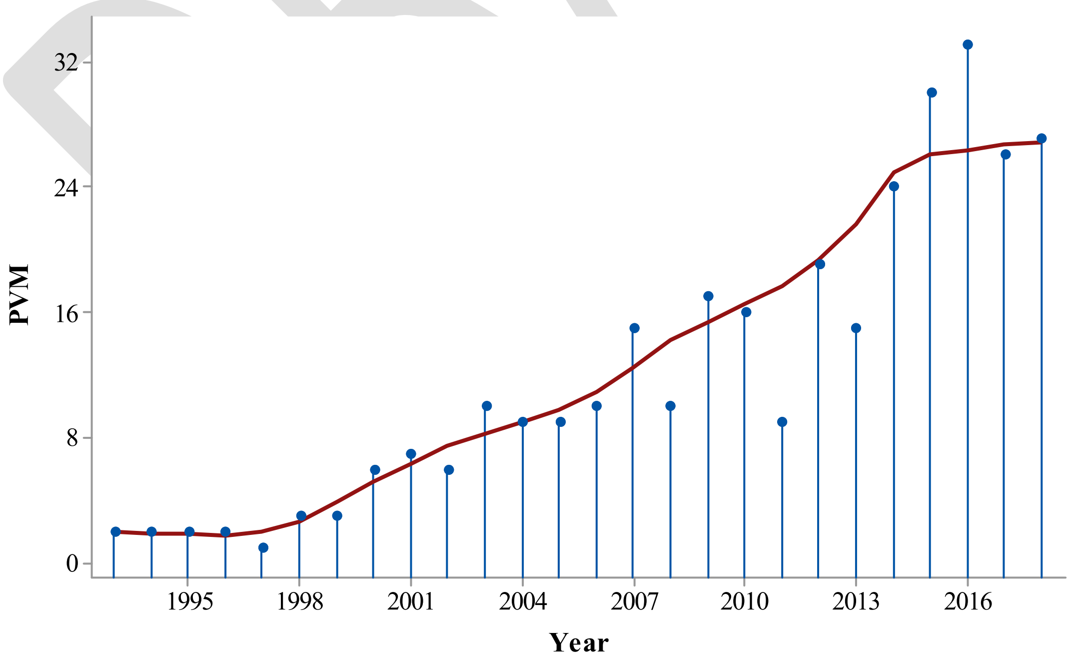


Figure 5-11. Panther/motor vehicle mortality from 1993 to 2018.

5.3 Effects of the Action on Florida Panther

This section analyzes the effects of the Action on the panther, which includes effects caused contemporaneously by the Action in addition to those that are reasonably certain to occur as a consequence of the Action at a later time. Our analyses are organized according to the description of the Action in Section 2 of this BO/CO.

5.3.1 Development and Mining, Base Zoning, Eligible Lands

39,973 acres of commercial development, residential development, and earth-mining activities will occur within a 43,767-acre development envelope (Covered Activities Area, Base Zoning, and Eligible Lands). This development will take place within and be principally clustered in areas of habitat least valuable to the panther. The approximately 3,794 acres (43,767 acres of Applicant-owned land with 39,97-acre development cap) the Applicants do not develop will be managed in perpetuity in their current land use or become managed to the benefit of Covered Species. The addition of these 3,794 acres to areas to be preserved, and managed to the benefit of species in perpetuity, are already calculated as part of the Preserve Area.

5.3.1.1 Habitat Loss

The Applicants propose to develop 39,973 additional acres in the Plan Area and preserve approximately 90,576 acres in designated Preserve Areas and Very Low Density Use Areas. These two categories of use represent 130,549 of 185,935 acres within the RLSA. Because the community of Ave Maria takes 5,027 acres from Collier County's 45,000-acre development cap, development proposed by the Applicants will take the remaining balance of lands eligible for high density development in the RLSA.

To estimate the effect of this habitat loss on the Florida panther population we 1) estimated the population size of Florida panthers in the Plan Area; 2) relied on more recent analyses of habitat use by panthers to estimate the demographic value of habitats' contribution to overall ecological carrying capacity; and 3) subtracted habitat likely to be lost to Covered Activities to arrive at the equivalent value of carrying capacity loss for Florida panthers.

The HCP assumes it is likely, though not intended, that the "worst case scenario" for development in the Covered Activities Area would impact preferred panther habitat, first. Panther activity is concentrated in native forested cover types and in other habitat types within 300 m around native forest. Therefore, we use the RMI method described in section 2.1.4 to estimate the extent of development in panther habitats, and assume that all panther-preferred habitat is taken first in the course of development. Native forested cover types cover 2,418, 110, and 3,505 acres of the Development and Mining, Base Zoning, and Eligible Lands designations, respectively (Sum of wetland and upland forests, Table 5-4). These 6,033 of native forest, and 24,583 acres of habitat within 300 m of native forest types, equals a total of 30,616 acres. This is less than the development cap of 39,973 acres (Tables 5-5 and 5-6).

The conversion of habitat within the development envelope from their current uses, to proposed development, will affect the ability of the Plan Area to support panthers. Specifically, 102,352 acres of habitat for panther exist within the Plan Area (forest cover plus all other habitats within 300 m of forest cover) (Table 5-6). As described in the HCP our analysis includes these assumptions: (1) the Applicants avoid development and earth-mining activities in the most valuable habitat for panthers whenever possible, and (2) all Lands Eligible for Inclusion do eventually join the HCP, we estimate the proposed action (Covered Activities Area, Base-Zoning Area, and Lands Eligible for Inclusion) will permanently remove approximately 2,418 acres of upland and wetland forest (Column B, Table 5-6). Additionally, 11,342 acres of land used for agriculture, 1,813 acres of marsh-shrub-swamp, 998 acres of pasture (prairie-grassland), 3,361 acres of Prairie-Grasslands, and 754 acres of lands used for all other purposes within 300 m of forest will also be converted to residential development, commercial development, or be used for earth-mining. This will result in the loss of 18,872 acres of total habitat used by Florida panthers in the Plan Area (Column F, Table 5-6).

To quantify the value of these habitats to panthers and their ability to sustain individual panthers, based on observed use and habitat availability, we used a Panther Preference Factor, a metric of panther use of different habitat types, as opposed to the South Florida RFP model (Frakes et al. 2015), which analyzes probability of panther presence on landscapes. The Panther Preference Factor is the inverse of habitat preference ratios identified by Onorato et al. (2010) (1/third-order habitat selection ratio), to weight areas of habitat impacted by the action by their value to panthers (Column D, Table 5-6). We then multiplied these weights against the available panther habitat acres in the plan area to generate a Preference-Weighted Plan Area Habitat Acres estimate for each habitat type available. Thus, we estimate the Plan Area's actual value to panthers, based on habitat use and availability is equivalent to 138,848 preference-weighted acres (Column E, Table 5-6). We then multiplied the Panther Preference Factor against the Panther Habitat Acres we expect to be developed within the Development Envelope to obtain Preference-Weighted Development Envelope Acres, a measure of the value of habitat that will be lost to panthers, based on use and availability, because of development (Column I, Table 5-7, and Appendix G). Subtracting the latter from the former gives us the Post-Development Preference Weighted Habitat Acres that will remain in the Plan Area after development is complete, which we estimate will be 117,330 Preference-Weighted Acres.

One method of estimating the impact of the action on panthers is identifying the proportion of area affected by development. To find the extent of area unchanged by the proposed action we divided 117,330 acres by 138,848 acres, yielding a calculated estimate of 84.5 percent of habitat that won't be affected by the action based on actual habitat use and availability. The inverse of this (1-0.845) is 0.155, the product of which indicates the area of habitat that will be affected based on use and availability. Assuming ~15 panthers use some portion of the Plan Area as part of their home range (based on past telemetry records), we would expect development and earth mining (excluding eligible lands) to reduce the population of the Plan Area from 15 individuals to 12.7 (15 x 0.84 = 12.7 panthers), meaning the action will reduce the number of panthers using the Plan Area up to the equivalent of 2.3 adult panthers (15 x 0.155 = 2.3).

As discussed in Section 5.2.1, recent research found that panther densities in and near the Plan Area are higher than previously estimated, elsewhere, and range between $3.9/100km^2$ and $4.03/100km^2$ (Onorato et al. 2020). Based on the availability of habitat in the Action Area a density-based population size estimate ranges between 16.2 and 16.6 panthers utilizing the Plan Area at any given time, and that proposed development will account for decrease in this population equivalent to 2.5 - 4.4 panthers (Table 5-7). Specifically, the loss of 30,616 acres of panther habitat in the Development and Mining, Base Zoning, and Eligible Lands Envelope would incur a loss in carrying capacity equivalent to 4.3 and 4.4 panthers/year at full buildout. Similarly, 18,872 acres of estimated development in an envelope only containing developable and minable lands in the HCP Cover Activities Area and Base Zoning categories reduces the estimate of carrying capacity reduction to between 2.5 and 2.6 panthers (Table 5-7). Based on the average of these estimates (3.5) we conclude habitat necessary to fully support at least 3 panthers will be lost as a result of proposed development. Conversely restoration of 17,605 acres of agricultural lands to forest cover in the Preserve area could boost the Plan Area carrying capacity by the equivalent of 1 to 3 panthers, annually. However, although one of the purposes of the Marinelli Fund is habitat restoration, the Applicants have not provided details regarding the location or magnitude of habitat restoration that would allow us to provide a quantitative estimate of any potential offset to the projected habitat loss.

These decreases in carrying capacity from loss of habitat in the Plan Area will likely also have secondary effects on panthers beyond its boundary. For instance, it is likely intraspecific aggression beyond the Plan Area boundary will increase when such resources within the Plan Area are reduced. As it stands 14 panthers were killed between 1980 and 2018 within the Rural Lands Stewardship Area, which includes lands of the Plan Area and areas immediately adjacent to it, due to intraspecific aggression. These individuals make up 15.7 percent of all individuals known to have died from intraspecific aggression, range wide. Our expectation is that mortality attributable to intensified competition for resources, manifested as interspecific aggression, will increase beyond this baseline within and beyond the boundaries of the Plan Area as a result of habitat loss from HCP-proposed development. Habitat loss that sufficiently reduces the availability of resources to panthers in the Plan Area can also force panthers to abandon home ranges overlapping the Plan Area, or force young adults to disperse greater distances, which can increase their risk of injury and death from other sources (*e.g.,* vehicle collisions).

As mentioned previously, we estimate between 23 and 12 percent of the panther population (assuming a population size of 120 or 230 adults, respectively) use habitats in the Plan Area for feeding, sheltering, denning, or dispersal each year. Given these represent high percentages of the total estimated population of Florida panther, it is likely habitat loss and fragmentation in the Plan Area may undermine the ability of the Plan Area to support a significant part of the overall panther population using it for a portion of their home range. It is also likely that habitat loss in the Plan Area may also reduce the resource value of the Plan Area to a substantial share of young, non-resident panthers during dispersal if adequate dispersal corridors and habitat linkages are not maintained. In both cases it is likely these will have range wide effects to the species. Two such corridors/linkages exist within the Plan Area: namely Camp Keais Strand and Okaloacoochee Slough. These secondary and tertiary effects of habitat loss in the Plan Area are discussed more fully in the appropriate, following sections.

5.3.1.2 Habitat Fragmentation

New developments and roads proposed by Applicants to connect new developments to each other and to main roads, as well as increasing traffic volume on new and existing roadways may contribute to habitat fragmentation. The potential impacts of habitat fragmentation to the panther are described in 5.2.2.2. The Applicants provided no information to the Service directly regarding the possible locations of new roads or an estimate of traffic volume on them, thus we will rely on the mortality estimates provided in Sections 5.3.1.3 and 5.3.1.4 to partially predict the effect these will have on population growth, if not population connectivity.

Due to likely increases in traffic volume in the Action Area panthers that breed, feed, shelter, and disperse in the area of the 1,825 miles of existing roads (including 91 miles that will require upgrade) and 83-87.5 miles of new roadways likely to be built in the future, will find it more dangerous to cross roads or will avoid crossing roads during peak periods of traffic. The spatial extent of these roadways, which will act as barriers to travel by panthers across the landscape, encompass the full expanse of Zone A of the Functional Zone. 94 percent of these roadways are within 25 miles of the HCP boundary, which encompasses a majority of panther habitat south of the River.

HCP proposed development will also contribute to habitat fragmentation affecting connectivity between the Big Cypress Core Habitat Region and Okaloacoochee Slough Core Habitat Region, and between these and Core Habitat Areas north of the Caloosahatchee River, by intensifying existing barriers. Assuming 10,000+ vehicles per day constitutes a near-complete barrier to panthers (see Section 1.1.6.2; Charry and Jones 2009) we offer the following analysis for habitat fragmentation caused by traffic. Our analysis of the Traffic Model for Action Area roadways identifies 535 miles of existing roadways that will cross the 10,000+ vehicles/day threshold by 2070 (Figure 5-12). The analysis also identifies 278 miles of roadways that will move from "onset" to "peak" impacts to wildlife (<3000 vehicles/day before to 3000-6000 vehicles/day after) by 2070. Traffic volumes in this range are expected to increase risk to all wildlife, including panthers (Charry and Jones 2009). Existing roads at 10,000+ vehicles/day now and existing roads that will exceed the 10,000+ vehicles/day threshold because of future traffic from the Plan Area will decrease panther access to ~729.5 km^2 (180,263 acres, or 8 percent) of Functional Zone habitat within and adjacent to the Corkscrew Regional Ecosystem Watershed (CREW). These effects can be minimized with measures that include but are not limited to, installation of wildlife crossing(s) and fencing, enforcement of speed limits, and panther corridor establishment/management.

Presently, four wildlife crossings facilitate access to the southern portion of CREW, and one facilitates movement within it. Three of these exist on a singular corridor into and out of CREW from the south (through Camp Keais Strand), while a fourth appears to facilitate panther movement southward into Golden Gate Estates. Currently, there are no wildlife crossings on the ground to facilitate dispersal of panthers from CREW northward across SR-82 and CR 876/Daniels Parkway, or across current (*e.g.,* Lehigh Acres) or future barriers (*e.g.,* HCP development). On January 28, 2020, the Applicants amended the HCP to add a second panther corridor north of CREW and acreage to the corridor along the Collier-Hendry county line (Figure 5-13). This second corridor was designed to maintain a minimum width of 400 meters and intersects the FDOT wildlife crossing location on SR-82 at Under Canal (approximately 0.7 mile west of the intersection of SR-82 and Corkscrew Road). With the addition of this corridor, the HCP provides landscape connections through both FDOT wildlife crossings on SR-82. An additional crossing, which the county and state have designed and funded at Corkscrew Crossings, has yet to be constructed. Upon construction, though, this crossing should provide additional panther access to this area of habitat and reduce current high mortality at this location. When completed, these crossings will provide vital access to approximately 383.8 km^2 of habitat that facilitates dispersal of panthers from the northern boundary of the CREW habitat region to the Caloosahatchee River.

Existing and proposed barriers also reduce the ability of panthers to access the Okaloacoochee Slough State Forest from CREW to the west and the Big Cypress NP to the south. These corridors are bisected by SR 29 (from Immokalee to La Belle) and CR 846 (Immokalee to County Line Road). Currently there is only one crossing servicing this ~30-mile stretch of roadways. Projected increases in HCP-generated traffic will substantially reduce panther access between these locations (Figure 5-12).

An additional barrier already exists along ~30 miles of roadways spanning SR-80 from Labelle to where it joins with SR-27 at Whidden Corner on to Clewiston. Most stretches of the road already exceed 10,000+ vehicles/day, and there is only one wildlife crossing. The 4 miles of this route that don't exceed this threshold are likely to become areas of substantial impact (3,000-6,000 vehicles/day) as a result of proposed HCP-generated traffic, which will further intensify the impact of this barrier on panther movement across the landscape. This stretch of road is very important because it cuts across the Dispersal Zone. Local and state agencies are currently constructing an additional wildlife crossing on SR-80, which will provide additional access for panthers to move through this barrier to areas north of their present breeding range.

However, the most significant contribution of HCP sourced traffic volume to fragmentation is its potential to contribute to the intensification of the barrier effects along north/south series of roadways that can result in bisection of the Functional Zone, potentially splitting it into two sections of roughly ~4,500 km^2 each. Traffic generated by development proposed in the HCP will intensify along ~89 miles of roadways beginning on SR-29 near La Belle, extending southward to its junction with the Tamiami Trail, then eastward along the Tamiami Trail to the vicinity of the Paolita Station, which is the terminus of the District 1 traffic model.

Specifically, our analysis of the traffic model indicates some of SR-29 from La Belle to its intersection with I-75 is already over the threshold of 10,000+ vehicles/day that serves as a nearly complete barrier to all taxa. If projected HCP-generated traffic is realized, nearly all of SR-29 from LaBelle to I-75 will exceed the 1,000+ vehicle/day threshold. Development proposed in the Plan Area would also nearly triple AADT from the intersection of I-75 and SR-29 southwards, along SR-29 to Tamiami Trail, then eastward along it to at least Paolita Station. This increase in traffic volume will fall within the range of substantial impacts to carnivores, including *Pumas*, of 3000-and 6000 vehicles/day (as defined by Charry and Jones 2009). There are currently 6 wildlife crossings on SR-29, 4 north of I-75 and 2 south of I-75. Additional crossings will likely be needed to minimize the effects of projected increases in HCP-generated traffic (and other development activities).

To address the effects of new and intensifying habitat fragmentation and vehicle mortality from increasing regional traffic the Applicants have committed the first $12.5 million from the Marinelli Fund to facilitate the construction of wildlife crossings. Based on the opinion of species biologists that have previously worked to establish wildlife crossings for panthers in the past, which estimated a cost of $1.5 million per crossing, we estimate the amount pledged by the applicants would enable the construction of about 8 wildlife crossings and associated fencing. As part of adaptive management, the applicants will work with local, state, and Federal partners to place these crossings in areas of greatest need. SR 29 from Immokalee to I-75 and other locations identified by the PRIT Transportation Subcommittee have already been identified as areas in need of more crossings. Therefore, we expect crossings across these roadways will help ensure that important panther habitats will not become isolated. Cooperation among permittees is built into the HCP, which can help plan crossings across ownership, ensure that suitable habitat remains on either side of the crossing, and that fencing and gates are maintained and used properly. These crossing will help offset traffic from HCP projects and from other sources as well.

Additionally, though local, state, and Federal partners are in various phases of pre-planning for an additional 4 crossings, the Service has not yet consulted on these, so we cannot assume they are reasonably certain to occur. A fifth crossing is planned and funded for Corkscrew Road, but won't be constructed until it's been determined traffic volumes justify widening the road at this location. However, this crossing is more than 2 miles from the nearest cluster of panther mortalities and wouldn't be included in our analysis for that reason.

Quantifying the demographic impact of habitat fragmentation requires a more detailed analysis than we are capable of for this HCP because we lack precise information about where the developments will be built, how landscapes around them will be managed, and where future crossings will be located. We also lack information about immigration and emigration rates across roadways bisecting areas of habitat used by panthers that would serve as a starting point for analyzing the effects of increasing habitat fragmentation. Thus, our PVA (section 5.5) does not include explicitly defined estimates of demographic impacts from habitat fragmentation. However, the PVA does incorporate estimates of impacts from highly related sources of mortality identified in Moss et al. (2016a) and discussed in more detail in sections 5.3.1.3 and 5.3.1.4. Therefore, we believe our estimates of mortality in each of those sections capture some, if not most, of the primary effects of increased habitat fragmentation within the immediate vicinity of the Plan Area and this is reflected the results of our PVA described in Section 5.5.

5.3.1.3 Habitat Degradation

Habitat degradation refers to the reduction in quality in an area of habitat for a given species. A species may still inhabit an area where habitat degradation occurs, but certain life history functions, such as reproduction, may no longer be successful.

<u>Decline in Prey Abundance</u>

Habitat loss discussed in Section 5.3.1.1 will affect the panther's prey as well as the panther. In addition to the reduction in prey using these habitats, we expect the establishment of new developments in the Plan Area will shift the wildland/urban interface (WUI) closer to the Big Cypress Core Habitat Region and Okaloacoochee Slough Core Habitat Region , the only Core Habitat Regions occupied by panthers (USFWS Draft 2020). When this occurs, we anticipate there will be a shift in the composition of the prey community and prey selection by panthers near the new WUI as has been observed elsewhere for cougars (Burdett 2010, Moss et al. 2016, Blecha et al. 2018, Alldredge et al. 2019, Coon et al. 2019, Kreling 2019). Specifically, numerous studies have found that urbanization results in the proliferation of cosmopolitan species such as rats and racoons, the introduction of exotic species that compete with or prey on native species, the concentration of other species like white-tailed deer in exurban and urban areas, and the switching of *Puma concolor* to smaller prey items to reduce prey handling time where interruption by human activity becomes common. Concentration of traditional prey species like white tailed deer in exurban and urban areas increases the risk of Florida panthers we be subject to mortality or removal, while prey switching will increase the possibility panthers using lands near the WUI will contract disease or be poisoned by contaminants. The reduction in preferred prey increases the likelihood panthers near the new WUI will experience nutritional stress and engage in depredation of domestic species; more frequently engage in intraspecific aggression with, and predation of and by, other apex predators; and increase the likelihood panthers will engage in intraspecific aggression with other panthers occupying neighboring home ranges. Thus, the impact of proposed development near otherwise suitable habitat will cause additional injury or death of panthers. The decrease in prey abundance or change in prey community composition and corresponding increase of injury or mortality of panthers near the new WUI will be indicative of degraded value of otherwise suitable habitat near HCP proposed development.

<u>Human Activity</u>

Impacts from construction (e.g., noise, smoke, land/vegetation clearing, earth moving and grading, dewatering, construction of buildings and infrastructure) and use of completed facilities will occur in the development footprint. Specifically, we estimate that noise, dust, and pollution from development may degrade habitat up to 300 m outside the development footprint. Some activities associated with mining (e.g., blasting) may temporarily extend farther by affecting panthers up to 1,000 m away during earth mining activities (HCP). During the construction phase some of these activities could cause panthers and/or their prey to avoid these areas until construction is completed. However, effects like noise from humans working and living in newly constructed communities and commercial facilities, pollution, and exposure to disease and harassment from interactions with pets and wildlife exposed to them, and potential management removal of individuals that become problematic for residents will persist as long as human development is present on the landscape. Studies in other regions of the country have found that other populations of *Puma concolor* have switched their prey preference to cosmopolitan meso-predators and rodents because of their elevated relative abundance and shorter handling times when the possibility of interruption by human activity becomes common. We expect the movement of the WUI via HCP proposed development closer to occupied Core Habitat Regions of the Florida panther's range (USFWS Draft 2020) will have similar effects and that these changes to the panther's environment will result in a permanent reduction in the value of adjacent areas of habitat used by panthers.

Environmental Contaminants

In the Santa Monica Mountains National Recreation Area SMMNRA 83–93 percent of coyotes, bobcats, and cougars had measurable concentrations of anticoagulant rodenticides (ARs) in body tissues, with 4 cougars known to have died from anticoagulant rodenticide toxicosis (Section 5.1.6.3). These poisonings have been attributed to bioaccumulation in cougars via the consumption of rodents poisoned with these near the urban/wildlands interface (Riley et al. 2007, Moriarty et al. 2012). As mentioned previously, *Puma concolor* have been documented as shifting their prey to more abundant meso-predators and rodents where development is present, meaning those with home ranges close to the new WUI are especially vulnerable to toxicosis when ARs are used. Our own spatial analysis (Appendix D) of exposure to ARs among Florida panthers, in addition to confirmed cases of lethal AR poisonings of other wildlife species in Collier County, gives us reason to expect failure to prohibit ARs in new developments proposed in the HCP will result in exposure and effects to Florida panthers similar to those observed among cougars and other species in the SMMNRA. The presence of environmental contaminants nearer the core range of the Florida panther increase the likelihood of injury or death of panthers, thereby diminishing the value of core habitat nearer to the new WUI of HCP proposed development.

Estimate of Effects

Moss et al. (2016a) examined puma foraging ecology and survival in an expanding urban–wildland system in Colorado from 2007 to 2013. For GPS-collared individuals, they related diet to age–sex class and fine-scale space use, with regard to levels of habitat development. They also examined how habitat development impacted risk of mortality, using hazards models and records of puma–human conflict. In their study, Moss et al. (2016a) found use of developed areas substantially increased risk of puma mortality; for every 10 percent increase in housing density, risk of mortality increased by 6.5 percent, regardless of sex. However, this risk is elevated compared with the management strategy in South Florida because a total of 62 percent (16 of 26) of mortalities in adult pumas were human associated. Of the human-associated mortalities, over half (n=10) were caused by lethal removal, either by a management agency or by private landowners. Other human-associated mortalities were hunting (n=3) and vehicular trauma (n=3). Natural deaths (n=5) were those caused by intraspecific conflict (n=3) or injury (n=2). The cause of death was undetermined for five individuals.

Since the proposed action will result 39,973 acres of new residential and commercial development within the 159,489-acre Plan Area, we estimate housing density in the Plan Area will increase by approximately 25 percent. Dividing this by 10 percent and multiplying the answer by 6.5 percent yields an estimate of 16.3 percent of panthers using the Plan Area each year potentially being taken from all causes related to the proposed development, at full buildout. In Section 5.2.1 we estimated a population size within the Plan Area was of 27.6 ±5.81 individuals using the plan area each year, meaning a maximum of 33.4 (27.6+5.81=33.41) panthers likely utilize the Plan Area, annually. Thus, we estimate an unadjusted likely maximum take of the equivalent to 5.2 adult panthers could occur annually as a result of lethal/injurious stressors generated by proposed development, within the Plan Area, at full buildout. When we adjust this range to account for roadways on which mortality was already estimated by other means (SEE SECTION 5.1.1.4 Motor Vehicle Mortality and Appendix A), and eliminate mortality from causes identified in the Moss et al. (2016) study that have no analog in the range of the Florida panther (e.g., hunting, lower management removal), we arrive at an adjusted estimate of the equivalent of ~1 adult panthers being lost annually, at full build out. These individuals will be taken from causes other than mortality on existing roadways and habitat loss due to residential development, commercial development, and earth mining activities. These sources of mortality may include but are not limited to:

- Increased mortality from intra-specific aggression among panthers displaced by proposed development and human activity;
- Increased mortality and decreased individual fitness caused by intensification of intra- and inter- specific competition;
- Increased predation of panther kittens from other predators when preferred prey populations decline;
- Effects to individuals from habitat loss, degradation, and fragmentation because of new roads connecting new areas of development to one another and the existing road network.
- Increased injury and mortality from collisions with traffic on new roads;
- Management removal because of depredation and human/panther interactions;
- Increased exposure to disease;
- Increased exposure to toxins

The PVA incorporates this estimate and is described in more detail below (Section 5.5). This estimate is above what is captured in current vital rates in the van de Kerk et al. (2019) PVA because it relates to new development.

5.3.1.4 Motor Vehicle Mortality

Panther deaths by vehicle collision are an important human-caused mortality type and highway exposure risk varies for individual panthers and across the landscape. This is true for panthers in the Action Area (see Sections 5.1.6.4 and 5.2.2.4). Much of the Florida landscape is characterized by high road density, and the probability of adult panther presence declines precipitously as the number of people and roads per unit area increases (Frakes et al. 2015). Benson et al. (2019) suggested that extinction probabilities could be reduced by increasing connectivity among puma populations and reducing risks of vehicle collisions.

Under section 7 of the ESA, the effects of a project are determined by comparing the baseline condition (in this case the current traffic volume in the Action Area) to the future condition with the project (in this case the increase in traffic volume predicted in the future due to HCP-generated traffic in the Action Area). The future traffic in the Action Area that is generated by sources other than the HCP is used for calculating cumulative effects later in Section 5.4, while traffic volume which is likely to be generated by the HCP are used for calculating future impacts of HCP-generated traffic volume on panthers in this Section.

While we consider effects of the HCP, such as the increased levels of traffic on roadways that wouldn't occur but/for the construction of HCP-proposed developments, we acknowledge that the Applicants are not responsible for all cars on the road or the behavior of drivers that may contribute to collisions with panthers and that other entities also influence when and where roads may be built or widened, and resulting traffic will also pose additional risks to panthers.

However, the Applicants do have control over locations of development within Plan Area and the design of developments, such as their size, number of development units, and internal trip capture rate. This means, though it would be impossible to assess the contribution of the Applicants' actions to specific instances of panther/vehicle collision in the future, it is possible for us to analyze the influence of HCP-generated traffic on the overall risk of panther/vehicle collisions in the Action Area.

The Applicants are willing to collaborate with agencies responsible for road construction or improvement, and with other panther stakeholders, to reduce the risk of panther/vehicle collisions. They have proposed conservation measures that will reduce the risk of panther/vehicle collisions throughout the range of the species. These conservation measures include facilitating the construction of additional wildlife crossings and maximizing community capture of vehicle trips through the provision of services within developments that limit the need for residents to travel outside of developments on area roadways. Measures such as wildlife crossings will reduce mortality among panthers from HCP and non-HCP sources, alike. For the purposes of the PVA, we have estimated that the effectiveness for wildlife crossings is 80 percent and internal trip capture at 50 percent. A currently unquantifiable benefit of the HCP is that if a crossing is proposed on HCP covered lands, we can work with ECPO landowners to ensure that habitat for panthers is maintained in perpetuity on both sides of the road, and adequate fencing and gating is installed and maintained. These features will increase crossing effectiveness and enhance wildlife corridor functionality that will be greater than what is currently estimated in the PVA. Although this coordination would be possible without the HCP, it would be probable with the HCP in place.

AADT is a common metric used for transportation planning at local, state, and federal levels and the metric we selected as an indicator of future traffic volume from HCP and non-HCP sources. We obtained estimates of future traffic from either source by using the FDOT District 1 Regional Planning Model (D1RPM) to predict traffic levels in the Action Area at full build-out based on socioeconomic projections (residents/jobs) for southwest Florida. We adjusted the regional socioeconomic projections to account for the addition of 174,000 residents and 91,480 dwelling units proposed in the HCP at a density and internal trip capture (~50 percent) comparable to that in the Ave Maria development. Then we applied these assumptions on existing roads within the Plan Area where these developments are most likely to occur. This analysis is described in more detail in Appendix H.

We found HCP-proposed developments will likely generate a portion of the total traffic volume in the future. Using the D1RPM and the adjustments describe above (Adjusted D1RPM Model), we estimate the proposed development in the HCP will generate 718,498 new daily trips on regional roadways that either originate in or terminate within areas proposed for development in the HCP. The range of contribution from the HCP on individual road segments in the model is between a 0 percent and 98.5 percent increase over current AADT.

To analyze the increased risk of this portion of traffic to panthers we do the following:

(1) determine the current panther mortality due to vehicle collisions on each road segment in the Action Area (Current Road Segment Mortality);
(2) calculate the average current traffic volume on each road segment with a history of panther mortality in the Action Area (Current Road Segment AADT in Action Area) (both inside and outside the Plan Area);
(3) identify the volume of predicted HCP-generated traffic for each road segment with a history of panther mortality in the Action Area (Future Road Segment HCP AADT in Action Area);
(4) estimate the predicted proportion of future panther mortality due to HCP-generated traffic on each road segment with a history of panther mortality in the Action Area (Future Road Segment HCP Mortality in Action Area);
(5) estimate the total predicted proportion of future panther mortality due to HCP-generated traffic (Future HCP Mortality in the Action Area).

The Applicants have included a plan-wide proposal (Marinelli Funds to construct wildlife crossings with fencing) to help reduce this risk. To analyze the predicted proportion of future panther mortality due to HCP-generated traffic after new crossings are constructed using these funds we do the following:

(A) review current panther mortality on high mortality road segments and select the 8 road segments with the highest total road mortality (Current Panther Mortality on High Mortality Road Segments);
(B) estimate the current traffic volume on each road segment with a history of high panther mortality in the Action Area (Current AADT on High Mortality Road Segments);
(C) estimate the volume of predicted HCP-generated traffic for each road segment with a history of high panther mortality in the Action Area (Future AADT on High Mortality Road Segments from HCP-generated Traffic);
(D) estimate the predicted proportion of future panther mortality due to HCP-generated traffic on each road segment with a history of high panther mortality in the Action Area (Future HCP mortality on High Mortality Road Segments);
(E) estimate the amount of mortality that is predicted to be reduced along each high mortality road segment when the conservation measure is implemented (Future HCP Mortality Reduction on High Mortality Road Segments);
(F) estimate the total reduction in mortality due to HCP-generated traffic on the high mortality road segments after the conservation measure is implemented (Future HCP Mortality Reduction due to HCP Conservation Measure); and
(G) estimate total future panther mortality due to HCP-generated traffic on road segments after implementation of the conservation measure (Future Reduced HCP Mortality in the Action Area).

<u>Motor Vehicle Mortality Associated with Effects of the Action</u>

The details of each step (step 1 through step 5) of this calculation can be found in Appendix H. The result is that 11 panthers per year (at full build-out) (Table 5-9) are predicted to be killed on road segments in the Action Area due to increases in traffic resulting from HCP-generated traffic (Appendix H).

Effect of Conservation Measures on Motor Vehicle Mortality

Although, wildlife crossings do not prevent every vehicle collision with a panther, every time a panther successfully uses a wildlife crossing that crossing was 100 percent effective for that panther on that day. Though we are unable to estimate the ratio of vehicle strikes per panther crossing attempt with available data, we are able to measure how many panthers were struck at a location before crossing installation and contrast that with how many were struck at the same location after.

To measure crossing effectiveness, we compared mortalities on a given roadway before and after crossings were installed. We created a spreadsheet listing each underpass currently existing south of the Caloosahatchee River in southwest Florida. For each underpass, GIS was used to look within ¼ mile of the underpass and determine the number of panther vehicle mortalities that occurred prior to underpass installation and after underpass installation. The goal was to determine how successful each individual underpass was in reducing mortality, and then take an average to get an average underpass effectiveness. These data did not readily lend themselves to individual underpass analyses since some underpasses had no recorded panther mortality either before or after crossing installation. Other locations had no recorded panther mortality before crossing installation and some panther mortality after.

These cases made it difficult to assign a percent to each individual underpass. Instead, we looked at crossing effectiveness as a function of the entire network of wildlife crossings, and compared the sum of all mortality for all underpasses prior to underpass installation to the sum of all mortality for all underpasses after underpass installation. The sum of mortalities within ¼ mile of the crossing, before installation, was 15 panthers. Afterwards, panther mortality within ¼ mile of crossings dropped to 3 panthers. Using the equation (1-(after/before))*100 we determined all existing underpasses were collectively responsible for reducing vehicle mortality by 80 percent. We also found that crossing effectiveness in reducing mortality was a function of distance from the crossing, with most of the benefit of a crossing decreasing substantially at one mile from its location.

That said, effectiveness of individual crossings varies depending on a variety of factors that include, but are not limited to: location and type of the crossing, the number of crossings per length of roadway, length of fence, surrounding habitat, and traffic volume. Specifically, crossings located close to forest edges will likely be more effective than those located farther, because 82 percent of all vehicle mortalities occur where a road intersects a forest edge or the 300 m buffer around one.

Lastly, hurricanes can knock down fencing and there have been incidents of gates being left open. Panthers use these unintended openings to access roadways and this has resulted in panthers being trapped between fencing, causing mortality and the need for management intervention. However, our analysis doesn't include a separate analysis of these incidents as our records don't always annotate when this occurred. For these reasons we believe the actual effectiveness of crossings over the long term is less than 100 percent. Thus, we believe the "effectiveness percentage" we calculated from the record as a whole (80 percent) is a reasonable estimate of the reduction in that risk on a landscape scale due to the construction of additional wildlife crossings.

As mentioned previously, the Applicants have committed $12.5 million from the Marinelli Fund to facilitate the construction of wildlife crossings. We estimate this amount would enable the construction of ~ 8 wildlife crossings and associated fencing (SECTION 5.4.2). The following steps were used to determine the reduced number of mortalities expected in the Action Area due to HCP-generated traffic once the crossings are considered.

(A) Current Panther Mortality on High Mortality Road Segments
(B) Current AADT on High Mortality Road Segment
(C) Future AADT on High Mortality Road Segments from HCP-generated Traffic
(D) Future HCP mortality on High Mortality Road Segments
(E) Future HCP Mortality Reduction on High Mortality Road Segments
(F) Future HCP Mortality Reduction due to HCP Conservation Measure
(G) Future Reduced HCP Mortality in the Action Area

For transparency, the details of each step in this calculation are presented in Appendix I. If the 8 crossings were located on road segments with the highest mortality rates, we estimate these crossings will reduce mortality from 11 individuals to 8 annually (11 - 3 = 8) in 2070 from traffic originating in the Plan Area (Table 5-9).

The Applicants have committed to providing further funds for the construction of additional wildlife crossings as they become available during the lifetime of the HCP. However, at this time we do not know how much additional funding will be available for this purpose, how many crossings these funds will facilitate, or where they will be located. It is also important to note our estimates of effect are contingent upon the assumptions made in the original traffic model. Future changes in the actions proposed in the HCP, such as increasing or decreasing internal trip capture, improvements to crossing effectiveness, or building more or fewer wildlife crossings can substantially change our estimate of the effects of the action on the panthers.

One of the more important assumptions made when the traffic model was produced was that future developments proposed in the HCP would have daily internal trip capture rates similar to the community of Ave Maria, which approaches 50 percent. However, recent proposals for residential communities submitted by the Applicants to Collier County in the Plan Area indicate some communities being planned will achieve an internal capture rate of 2 percent as indicated by the Applicants' planning documents. If developments that don't achieve the internal capture rate of Ave Maria are constructed, it is likely the traffic model will underestimate future traffic volume generated by development proposed in the HCP, and thus the total impact the proposed developments may have on panthers. If the Applicants build communities with a lower internal capture rate, but still use the $12.5 million to construct crossings (*e.g.,* 8 crossings are constructed), we would nonetheless expect higher panther mortality due to greater traffic on existing roads (Tables 13a and 13b in Appendix I). If more than 8 crossings can be constructed with the $12.5 M committed by the Applicants or if internal capture rates exceed the 50 percent target assumed in the traffic model, then the panther mortality in our model would be an overestimate. Our analysis of the spectrum of possible effects that could occur as a result of different decisions with regards to crossings and internal capture is provided in Appendix I.

How wildlife crossings are built can also have an effect on the impact of traffic generated by the HCP on panthers. For instance, the Applicants could also implement measures that improve the effectiveness of wildlife crossings. Locating crossings in areas where natural habitat provides corridors frequently used by panthers, placing multiple crossings in longer hot spot segments, extending fencing, and landscape design can all increase the survivorship of panthers after wildlife crossings are built. A currently unquantifiable benefit of the HCPs is that if a crossing is proposed on HCP covered lands, we can work with ECPO landowners to ensure that habitat for panthers is maintained in perpetuity on both sides of the road, and adequate fencing and gating is installed and maintained. An example of this occurred recently when Alico voluntarily reconfigured their land use plans to align conservation land on both sides of a planned Florida DOT wildlife crossing on S.R. 82. Depending on the location, these features could increase crossing effectiveness and enhance wildlife corridor functionality that will be greater than what is currently estimated in the PVA. Although this coordination would be possible without the HCP, it would be probable with the HCP in place.

Another step that could improve the effectiveness of wildlife crossings is to plan them in aggregates that form networks for panther dispersal across the landscape. However, the HCP does not identify explicit targets for internal trip capture, a maximum number of crossings, where they will be located, or what measures they are likely to take to maximize their effectiveness. Thus, our analysis remains confined to the assumption of 50% internal trip capture in newly constructed communities and the construction of a minimum of 8 wildlife crossings.

In the meantime, our analysis does take into account wildlife crossings currently being constructed at the initiative of county and state authorities. To our knowledge, these parties are currently in the process of constructing 3 wildlife crossings and planning construction of 5 additional crossings. However, we have not consulted on 4 of these yet, so we can’t reasonably assume they will be constructed. The fifth has been consulted on and is funded, but will not be constructed until road widening is needed on Corkscrew Road. However, this crossing is more than 2 miles from the nearest cluster of panther mortalities and wouldn’t be included in our analysis for that reason.

5.3.2 Preservation Activities and Very Low Density Development

Both the Plan and Preservation Areas are located in habitats that are regularly used by panthers for feeding, breeding, and sheltering (Section 5.2.1). The designated Preservation areas are 90,576 acres in extent, and within them, we identify 69,342 acres of habitat frequently used by panthers (forested area + all other available habitat types within 300m of it, Table 5-5). This habitat makes up approximately 68 percent of all panther habitat in the Plan Area. When the effects of 1m of SLR and projected development to 2070 are applied to the South Florida RFP model (Frakes et al. 2015) (Table 7.3 in USFWS Draft 2020) the Service estimates that up to 840 km^2 of panther habitat as it is defined by that model could be lost from the area south of the Caloosahatchee River currently supporting the only breeding population of panthers. Securing 69,342 acres (280.6 km^2) of panther habitat in perpetuity will help offset this loss.

The location of the Preservation Area is as, or more, important than simply the number of acres being preserved. The Preservation Area is part of the Okaloacoochee Slough wetland ecosystem linkage that is adjacent to agricultural lands that lie between BCNP and Okaloacoochee Slough State Forest (OSSF). This critical linkage is a broad swath of occupied panther habitat. Without the Preservation Area included in this HCP, and if current development trends persist, this linkage would likely be developed/degraded and could cease to function, or function less effectively, as a corridor connecting BCNP and OSSF. The loss or degradation of this corridor could inhibit the natural dispersal (population expansion) of panthers needed for the recovery of the species.

The Applicants propose a continuation of existing land uses (agriculture, silviculture, etc.) in the Preservation areas, which we listed in section 2.3. All of these uses may occur to some extent in the Preservation areas. The Applicants have agreed that the future land uses in the Preserve areas will remain mostly the same, negligible in effect of any change, or become more beneficial to panthers. The Applicants have proposed the following land use activities, some of which may improve habitat for panthers and other species in the Preservation areas:

- prescribed burning;
- mechanical control of groundcover (*e.g*., roller chopping, brush-hogging, mowing);
- ditch and canal maintenance;
- oil and gas exploration
- mechanical and/or chemical control of exotic vegetation; and
- similar activities that maintain or improve habitat quality.

Implementation of these activities may temporarily cause panthers to avoid areas while they take place. It is unlikely that that any of these activities would result in injury or death of panthers. Because the Service has documented rare incidences of mortality from wildfire in the past we have developed best management practices for prescribed fire. The Applicants have committed to performing surveys for listed species prior to these actions and we believe these will reduce the potential for injury or death. The Applicants will also verify with FWC prior to burning that there are no known denning locations within the treatment area. Because documented instances of panther injury and mortality from these actions are rare, we believe that if the Applicants perform pre-action surveys and adaptively plan their activities around the results of these, the risk of injury to panthers will be discountable.

In Chapter 4.2.3.2 of the HCP, the Applicants propose to restore, preserve, and maintain panther habitat in the Preservation and Very Low Density use designations. The HCP does not specify performance measures (amount or extent, functional gain) for such restoration and enhancement activities. However, at minimum we expect the proposed management of Preservation areas to maintain the current numbers, reproduction, and distribution of the panthers in the Preservation areas, because these activities would, at minimum, maintain current conditions. Restoration of

17,605 acres of agricultural lands to forest cover in the Preserve area could result in sustaining the equivalent of 1 to 3 panthers, annually. However, the Applicants do not suggest habitat restoration of this scale is planned to occur during their implementation of the HCP.

The applicants also propose to replace habitat for other species, such as the caracara, that is lost during development. The HCP does not indicate where in the Preservation area restoration for other species will occur. Depending what type of habitat change occurs, the change could be beneficial or detrimental to panthers. For example, forested land that is converted to pasture would be detrimental while row crops converted to pasture would be beneficial.

The applicants also propose to do wetland restoration, but do not explain where restoration will occur or the type of restoration that will be done. As with the restoration for other species, wetland restoration could be beneficial or detrimental to panthers depending on the location, type, and magnitude of restoration.

The Very Low Density (VLD) use areas of the HCP contain 2,667 acres of panther habitat that could support panther breeding, feeding, sheltering, and dispersal (Table 5-4). Proposed land uses in the VLD areas are similar to the Preservation areas, but may also include isolated residences, lodges, and hunting/fishing camps, at a density of no more than one dwelling unit per 50 acres. The Applicants would continue current ranching/livestock operations and other management activities as described for the Preservation Areas (e.g., exotic species control, prescribed burning). As in the Preservation areas, we do not expect adverse effects resulting from the continuation of the existing land management regimes to exceed present. The HCP does not specify a footprint for the isolated residences, lodges, and hunting/fishing camps, but indicates that their construction could clear up to 10 percent of the existing native vegetation (see section 2.5). New dwelling development could occur within any of the cover types present besides open water and existing development. It is possible that dwelling development in the VLD areas could entirely avoid panther habitat, but we conservatively estimate a 239-acre habitat loss (10 percent of the 2,394 acres of panther habitat). Construction within these areas may temporarily cause panthers to avoid these areas and diminish the value of surrounding lands to panthers, but we expect these effects to be insignificant.

5.3.3 Tables and Figures

Table 5-4. Acreage of Panther Habitat Categories that occur in the Plan Area

Panther Habitat Category	Development	Preservation	Very Low Density	Base Zoning	Eligible for Inclusion	Plan Area Total	Row Percent	Development Envelope Total
Agriculture	33,370	17,605	0	698	10,289	61,962	38.85%	44,357
Marsh-Shrub-Swamp	1,785	23,630	223	536	2,591	28,766	18.03%	4,913
Other	1,233	2,620	1,119	4	1,891	6,867	4.31%	3,128
Prairie-Grassland	5,446	10,544	507	1,082	1,783	19,361	12.14%	8,311
Upland Forest	1,696	9,704	309	16	1,052	12,777	8.01%	2,764
Wetland Forest	722	25,988	510	94	2,453	29,768	18.66%	3,269
Total	**44,252**	**90,092**	**2,667**	**2,431**	**20,059**	**159,501**	**100.00%**	**66,742**

Table 5-5 Panther Habitat by Category of Habitat within 300m of Upland Forest and Wetland Forest Cover and the forest cover, itself.

Panther Habitat Category	Development	Preservation	Very Low Density	Base Zoning	Eligible for Inclusion	Plan Area Panther Habitat	Development Envelope
Agriculture	11,342	9,181	0	418	3,174	24,115	14,934
Marsh-Shrub-Swamp	998	15,388	217	350	1,680	18,633	3,028
Other	754	1,987	867	2	915	4,525	1,671
Prairie-Grassland	3,361	7,094	491	727	862	12,534	4,950
Upland Forest	1,696	9,704	309	16	1,052	12,777	2,764
Wetland Forest	722	25,988	510	94	2,453	29,768	3,269
Total	**18,872**	**69,342**	**2,394**	**1,608**	**10,136**	**102,352**	**30,616**
Plan Area Total Acres	**44,252**	**90,092**	**2,667**	**2,431**	**20,059**	**159,501**	**66,742**
% Plan Area that is within 300m of Forest Cover	**42.6%**	**77.0%**	**89.7%**	**66.1%**	**50.5%**	**64.2%**	**45.9%**

Table 5-6. Florida panther habitat loss likely to result from development activities in the Development Envelope (Covered Activities Area, Base Zoning, and Lands Eligible for inclusion in the HCP). Irrespective of whether development occurs in the current HCP configuration, or after Eligible Lands join the HCP, the cap for future development will remain 39,973 acres.

A. Panther Habitat Category	B. Total Plan Area Panther Habitat Acres[1]	C. Panther Habitat Acres within Development Envelope[2]	D. Panther Preference Factor[3]	E. Preference-Weighted Plan Area Habitat Acres (B*D)	F. Preference-Weighted Development Envelope Acres (C*D)	G. Post-Development Preference-Weighted Habitat Acres (E-F)	H. Panther Habitat Acres within HCP Development/ Mining Designation	I. Preference-Weighted Development/ Mining Habitat Acres (D*H)	J. Post-Development Preference-Weighted Habitat Acres (E-I)
Agriculture	24,115	14,934	0.962	23,210	14,374	8,836	11,342	10,916	12,294
Marsh-Shrub-Swamp	18,633	3,028	1.252	23,321	3,789	19,532	998	1,249	22,072
Other	4,525	1,671	0.955	4,322	1,596	2,726	754	720	3,602
Prairie-Grassland	12,534	4,950	1.274	15,967	6,305	9,662	3,361	4,281	11,686
Upland Forest	12,777	2,764	1.880	24,016	5,196	18,820	1,696	3,188	20,829
Wetland Forest	29,768	3,269	1.613	48,012	5,273	42,739	722	1,164	46,848
Total	**102,352**	**30,616**		**138,848**	**36,534**	**102,315**	**18,872**	**21,519**	**117,330**

1. Forest cover plus the extent of all other cover categories within 300 meters.
2. Panther habitat within the Development, Base Zoning and Eligible HCP land-use designations.
3. The inverse of habitat selection ratios reported in Onorato et al. 2010.

Table 5-7 Habitat Loss interpreted as a reduction in Carrying Capacity for Florida panthers

Interpreting habitat loss as a long-term reduction in panther carrying capacity.

Variable	Source or Calculation	Value	Units	Measure
a	draft SSA	6,336	acres	Low panther density; 3.9/100km2 = 1 panther per 6336 acres.
b	draft SSA	6,178	acres	High panther density; 4.09/100km2 = 1 panther per 6178 acres.
c	Habitat Calculations B9	102,352	acres	Total Plan Area panther habitat acres (forest cover plus other types within 300m)
d	c/a	16.2	adult panthers	Plan Area low-density carrying capacity.
e	c/b	16.6	adult panthers	Plan Area high-density carrying capacity.
f	Habitat Calculations E9	138,848	weighted acres	Preference-weighted Plan Area habitat acres (total pre-development).
g	Habitat Calculations G9	102,315	weighted acres	Post-development preference-weighted habitat acres; capacity loss from the full development envelope.
h	Habitat Calculations J9	117,330	weighted acres	Post-development preference-weighted habitat acres; capacity loss from the Development/Mining HCP designation only.
i	(g/f)*d	11.9	adult panthers	Post-development Plan Area carrying capacity; low density; loss from the full development envelope.
j	(g/f)*e	12.2	adult panthers	Post-development Plan Area carrying capacity; high density; loss from the full development envelope.
k	(h/f)*d	13.7	adult panthers	Post-development Plan Area carrying capacity; low density; loss from the Development/Mining HCP designation only.
l	(h/f)*e	14.0	adult panthers	Post-development Plan Area carrying capacity; high density; loss from the Development/Mining HCP designation only.
m	d-i	4.3	adult panthers	**Reduction** in post-development Plan Area carrying capacity; low density; loss from the full development envelope.
n	e-j	4.4	adult panthers	**Reduction** in post-development Plan Area carrying capacity; high density; loss from the full development envelope.
o	d-k	2.5	adult panthers	**Reduction** in post-development Plan Area carrying capacity; low density; loss from the Development/Mining HCP designation only.
p	e-l	2.6	adult panthers	**Reduction** in post-development Plan Area carrying capacity; high density; loss from the Development/Mining HCP designation only.

Table 5-8. The eight high-mortality road segments selected. There is already a crossing being constructed on the shaded road segment, so this segment was not included.

Road Segment Identifier	2014-2018 AADT	2014-2018 Total PVM	2014-2018 Annual PVM	Portion of total traffic attributable to HCP	2070 HCP AADT	2070 Non-HCP AADT[1]	2070 Total AADT	2070 HCP PVM	2070 Non-HCP PVM	Total 2070 PVM
11416_11415	490	1	0.2	0.1559	1,604	5,042	6,646	0.65	2.058	2.713
27167_27202	11,860	5	1	0.6694	25,253	6,097	31,350	2.13	0.514	2.643
27369_24041	1,475	1	0.2	0.9762	19,210	268	19,477	2.60	0.036	2.641
27457_27458	3,814	2	0.4	0.9653	20,962	405	21,367	2.20	0.042	2.241
26919_26934	7,493	3	0.6	0.9719	17,772	234	18,006	1.42	0.019	1.442
27414_24845	1,762	1	0.2	0.9603	9,868	220	10,088	1.12	0.025	1.145
24039_27446	4,220	1	0.2	0.9652	20,953	401	21,354	0.99	0.019	1.012
27360_27362	10,842	1	0.2	0.9852	48,593	381	48,974	0.90	0.007	0.903
25001_25027	2,197	1	0.2	0.0242	422	9,415	9,837	0.04	0.857	0.895

Table 5-9. Predicted Florida panther vehicle mortality due to different sources related to the Eastern Collier Multiple-species Habitat Conservation Plan.

SOURCE OF MORTALITY	NUMBER OF PANTHER MORTALITIES/YEAR
Current Action Area	22
Predicted proportion of future panther mortality due to HCP-generated traffic	11
Reduced mortality due to HCP crossings	3
Predicted proportion of future panther mortality due to HCP-generated traffic after conservation measures	8

These numbers are contingent on all assumptions laid out in section 5.3.1.4

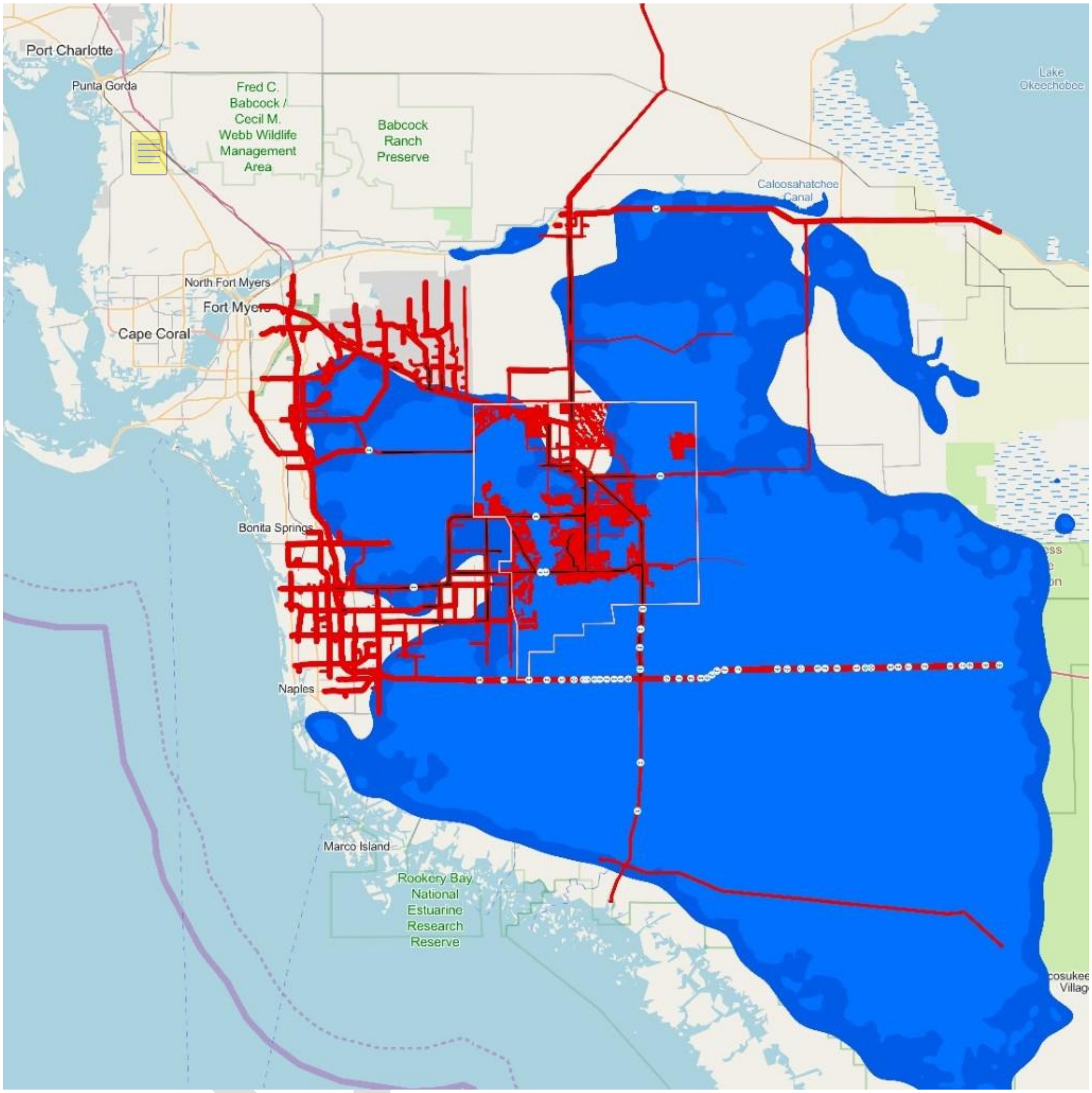


Figure 5-12. Barriers caused by roads and development in the Action Area, and wildlife underpasses can reduce the effect of the barrier. Increasing traffic on roadways and development (in red) will increase fragmentation of panther habitat. Impermeability is denoted by weighted lines (the thicker the line, the stronger the barrier it will be for panthers in 2070). Our analysis of the Traffic Model for Action Area roadways identifies 535 miles of existing roadways will cross the 10,000+ vehicles/day threshold by 2070, and 278 miles of roadways that will move from "onset" to "peak" impacts (<3000 vehicles/day before to 3000-6000 vehicles/day) by 2070. Roadways outlined in black will cross this threshold because of traffic generated by proposed development in the HCP. Small white symbols identify the locations of wildlife crossings constructed as of 2019.

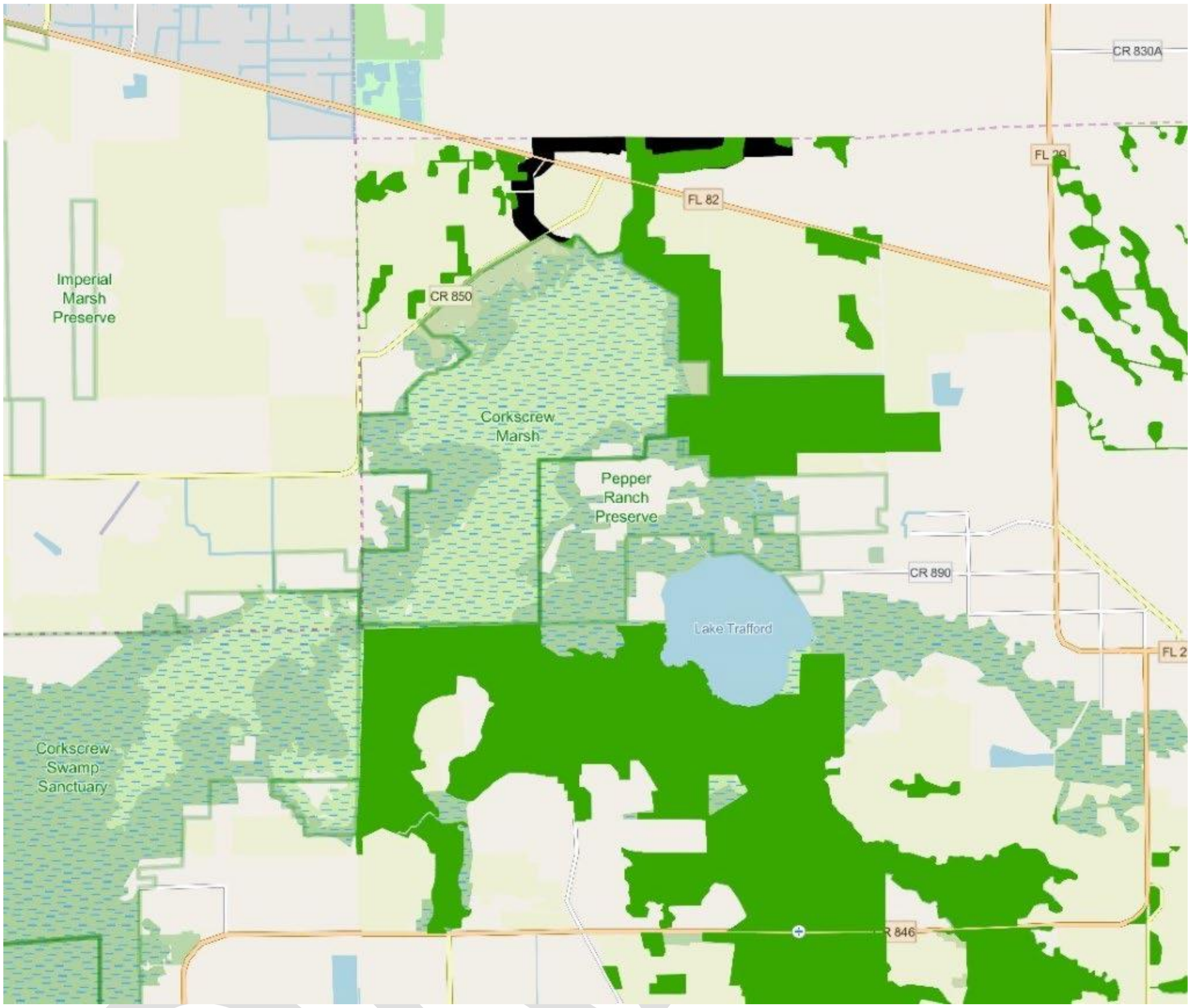


Figure 5-13. Close-up of the second Florida panther corridor and additional acreage in the first corridor that Applicants added north of the Corkscrew Regional Ecosystem Watershed on January 28, 2020. The green area represents the previous Preserve configuration, and the area shaded in black represents the addition of the new corridor configuration.

5.4 Cumulative Effects on Florida Panther

For purposes of consultation under ESA §7, cumulative effects are those caused by future state, tribal, local, or private actions that are reasonably certain to occur in the Action Area. Future Federal actions that are unrelated to the proposed action are not considered, because they require separate consultation under §7 of the ESA. This definition applies only to section 7 analyses and should not be confused with the broader use of this term in the National Environmental Policy Act or other environmental laws.

The Action Area was extended beyond the Plan Area to include roads impacted by traffic generated by the HCP (Figure 5-9). Within this Action Area our cumulative effects analysis analyzes the impact of increases in traffic volume from future, non-Federal, non-HCP sources we believe are reasonably certain to occur on the same roadways. Based on our review of past developments in the region we estimate approximately 25.3 percent of future, possible developments are pursued without review by the Service. Thus, we assume that 25.3 percent of traffic volume identified in the D1RPM would likewise originate from developments the Service would not have opportunity to review.

Because the requested duration of the ITPs is 50 years during which we anticipate full build-out, we used estimates of future traffic volumes in the year 2070. Specifically, we analyzed cumulative effects by:

(1) determined the current panther mortality due to vehicle collisions on each road segment in the Action Area (Current Road Segment Mortality).
(2) calculated the average current traffic volume on each road segment with a history of panther mortality in the Action Area (Current Road Segment AADT in Action Area) (both inside and outside the Plan Area);
(3) estimated the volume of predicted non-HCP generated traffic in 2040 for each road segment with a history of panther mortality in the Action Area (2040 Road Segment Non-HCP AADT in Action Area).
(4) estimated the volume of non-HCP generated traffic in 2070 for each road segment with a history of panther mortality (2070 Road Segment Non-HCP AADT in Action Area)
(5) estimated the 2070 panther mortality per segment due to non-HCP traffic (2070 Road Segment non-HCP Mortality in the Action Area).
(6) estimated the total non-HCP mortality in 2070 (2070 non-HCP Mortality in the Action Area).

The Applicants have included a conservation measure (wildlife crossings with fencing) to reduce this risk. Because the applicants' conservation measure will also reduce mortality due to non-HCP generated traffic, we will analyze the amount of non-HCP generated mortality reduced by the conservation measure. We also need to determine the panther mortality from non-HCP generated traffic after it is reduced by the conservation measure because we will consider that mortality in making our jeopardy determination.

Steps A through F represent how we predicted the proportion of future panther mortality due to non-HCP generated traffic after the conservation measure is implemented. Step G represents how we determined the panther mortality from non-HCP generated traffic after it is reduced by the conservation measure. The steps are as follows:

(A) review current panther mortality on high mortality road segments and select the 8 road segments with the highest total road mortality (Current Panther Mortality on High Mortality Road Segments);

(B) calculate the current average traffic volume on each road segment with a history of high panther mortality in the Action Area (Current AADT on High Mortality Road Segments);
(C) estimate the volume of predicted non-HCP generated traffic for each road segment with a history of high panther mortality in the Action Area (2070 AADT on High Mortality Road Segment from non-HCP generated Traffic);
(D) estimate the predicted proportion of future panther mortality due to non-HCP generated traffic on each road segment with a history of high panther mortality in the Action Area (Future non-HCP mortality on High Mortality Road Segments);
(E) estimate the amount of mortality related to non-HCP generated traffic that is predicted to be reduced along each high mortality road segment when the conservation measure is implemented (Future non-HCP Mortality Reduction on High Mortality Road Segments);
(F) estimate the total reduction in mortality due to non-HCP generated traffic on the high mortality road segments after the conservation measure is implemented (Future non-HCP Mortality Reduction due to HCP Conservation Measure); and
(G) estimate total future panther mortality due to non-HCP generated traffic on road segments after implementation of the conservation measure (Future Reduced non-HCP Mortality in the Action Area).

Motor Vehicle Mortality Associated with Cumulative Effects

For the purposes of transparency, the detailed calculations for this analysis may be found in Appendix J. Based on this analysis we estimate approximately 5 panthers per year will be killed by vehicle collision from non-HCP related traffic in the Action Area in 2070.

Effects of Conservation Measures on Motor Vehicle Mortality

As mentioned previously, the Applicants have committed $12.5 million from the Marinelli Fund to facilitate the construction of wildlife crossings as a conservation measure. Based on the opinion of species biologists that have previously worked to establish wildlife crossings for panthers in the past, which estimated a cost of $1.5 million per crossing, we estimate the amount pledged by the applicants would enable the construction of about 8 wildlife crossings and associated fencing. The following steps were used to determine the reduced number of mortalities expected in the Action Area due to non-HCP generated traffic once the crossings are considered.

(A) Current Panther Mortality on High Mortality Road Segments
(B) Current AADT on High Mortality Road Segments
(C) 2070 AADT on High Mortality Road Segment from non-HCP generated Traffic
(D) Future non-HCP Mortality on High Mortality Road Segments
(E) Future non-HCP Mortality Reduction on High Mortality Road Segments
(F) Future non-HCP Mortality Reduction due to HCP Conservation Measure
(G) Future Reduced non-HCP Mortality in the Action Area

The detailed calculations for this analysis are presented in Appendix K for transparency. As mentioned in Section 5.3.1.4., conservation measures implemented by the applicants on the 8 road segments with highest mortality, mortality of panthers associated with HCP-generated traffic is reduced by 3 panthers (from 11 to 8, Table 5-10). We estimate that panther mortality from non-HCP traffic will also be reduced by 3 (from 5 to 2). Therefore, the total predicted net reduction in panther mortality from 8 wildlife crossings is 6. The number of HCP and non-HCP-generated traffic panther mortalities predicted to occur after the conservation measure is considered is 10 panthers total (16 panthers from future traffic – 6 panthers saved from any source (HCP or non-HCP) due to the conservation measure) if 8 crossings are constructed (Table 5-10). If more than 8 crossings are constructed, fewer panthers are expected to be killed by vehicle collisions. For example, if 12 crossings are constructed the total reduction is predicted to be 10 panthers with a future annual mortality of individuals in the Action Area of 6.

5.4.1 Tables and Figures

Table 5-10. The number of Florida panther mortalities estimated from Eastern Collier Multiple-species Habitat Conservation Plan (HCP)-generated and non-HCP generated traffic anticipated in 2070. The number is given in total panthers with female only numbers in parentheses, where females represent ~ 40 percent of mortalities documented rounded to the nearest higher whole number.

EFFECT OF TRAFFIC VOLUME AND CONSERVATION MEASURES IN THE ACTION AREA	HCP-Generated Traffic Mortality (Females)	Non-HCP Generated Traffic Mortality/Cumulative Effects (Females)	Total Mortality (Females)
Future Mortality in the Action Area before Conservation Measure	11 (5)	5 (2)	16 (7)
Future Mortality Reduction due to HCP Conservation Measure (8 crossings)	3 (1)	3 (1)	6 (2)
Future Mortality in the Action Area after Conservation Measure	8 (4)	2 (1)	10 (5)

5.5 Population Viability Analysis

Population Viability Analysis (PVA) is a widely utilized, species-specific method of structured risk assessment that allows wildlife and fisheries managers to compare the potential effects of different proposed courses of action, and manners of carrying out proposed actions, on the viability of populations over time. For example, state-level wildlife resource agencies often use PVAs to inform many of the management decisions they make routinely, such as comparing the impact of different proposed harvest limits for game species, the likely effects of different habitat management proposals on affected populations, or developing initiatives from a range of alternatives aimed at conserving rare or declining species.

Federal agencies such as the Service, National Park Service, and National Marine Fisheries Service also regularly use PVAs as a tool of conservation decision making. The U.S. Fish and Wildlife Service specifically uses PVAs for environmental review, management of trust resources on Refuges, listing, and recovery - such as 5 Year Reviews, Species Status Assessments (SSAs), and Recovery Plans. Throughout the history of the Service's efforts to recover the panther, the Service has relied on the results of 8 PVAs to inform conservation measures and management actions and continues to do so. Platforms used to run peer-reviewed, published, panther-specific PVAs include freely and commercially available packages such as VORTEX, RAMAS GIS, and RAMAS LANDSCAPE, as well as those developed independently by academic researchers (Root 2004, Beier et al. 2003, USFWS 2008, USFWS Draft 2020).

Though PVAs are useful tools, the outcome of PVA does not represent the entire jeopardy analysis. This is because there are a number of measures committed to by the applicants that will help offset effects or that will provide benefits but that cannot be quantified at this time because of the programmatic nature of the HCP. These measures have been discussed throughout this document, and will be summarized again in a more comprehensive way in our jeopardy analysis. However, the PVA does inform us as to whether the effects of the action are likely to result in a measurable decrease or increase in the probability of survival and recovery over time.

5.5.1 The Model

We chose to analyze the action with PVA to remain consistent with these past and current practices and methods used to articulate conservation needs and threats identified earlier (Section 5.1.6). We also used PVA as a structured decision tool to compare different possible courses of action with respect to Service issuance of ITPs to the applicants participating in the Eastern Collier Multiple Species Habitat Conservation Plan. Specifically, we used PVA to analyze the impact of the proposed action on the abundance and probability of the panther's persistence for 100 years after full build-out. We chose the 100 year time horizon for our model to remain consistent with Shaffer's (1978, 1983, and 1987) definition of a minimum viable population, criteria for recovery defined in the Florida panther Recovery Plan (3rd Revision, 2008), other published PVAs, and the IUCN Vulnerability Assessment Criteria articulated by Mace and Lande, (1991) and Mace et al. (2008). Our PVA takes into account a wide range of assumptions regarding population size and resource availability south of the Caloosahatchee River to account for uncertainty in estimates used for inputs and the spatial and temporal variability in those estimates (accounting for stochasticity).

The PVA published by van de Kerk et al. (2019) is the most recent and robust of the panther PVAs produced to date. However, it was not spatially explicit and assumed current vital rates would remain constant over time. To account for the possibility of future changes in habitat availability, new sources of mortality, and changes in existing sources of mortality, we started with the van de Kerk et al. (2019) PVA inputs. We chose to bring these into a commercially available platform (RAMAS Landscape) for ease of replicability in a platform familiar to Service biologists. To ensure the RAMAS Landscape would faithfully reproduce the results of van de Kerk et al (2019), we loaded their inputs into RAMAS Landscape and validated against the outputs of the original model. Once satisfied the two platforms produced consistent results with the same inputs, we added predicted changes to current conditions, survivorship, and fecundity likely to be caused by:

- the proposed HCP (Effects of the Action); and
- future non-federal actions that are reasonably certain to occur (Cumulative Effects); and
- Sea Level Rise of 1m by 2070.

Each of these inputs are discussed in more detail in each section below.

5.5.2 Model Inputs and Assumptions

Because panthers are polygynous, the survival and reproductive success of female panthers control population dynamics; therefore, like other panther models, our model also focused on the female portion of a single closed population in south Florida. We acknowledge that one or more females have been documented north of the Caloosahatchee River recently, and that those female(s) have produced kittens. However, we do not have confirmation that these kittens survived to independence or that they are contributing to population expansion. Therefore, we assumed a closed population south of the Caloosahatchee River for this analysis.

Because we have a range of population size estimates, we assumed the true N_0 could be either 120 or 230 individuals, or some value in between. For the initial population size function (N_0) we used the low, midpoint, and high ends of the estimated current population size (FWC and Service 2017; N_0=120, 176, 230 adult panthers OR 60, 88, 115 females).

Similarly, because the true carrying capacity is unknown but Service and FWC biologists infer the population may be at or near carrying capacity (K), we also used variable values of K to represent conditions when panthers are utilizing all available resources south of the Caloosahatchee River or some portion of resources less than that. Thus, we assumed it is possible N_0 (the current population size) represents 100 percent, 80 percent, and 60 percent of carrying capacity. Specifically, for an initial population size of 60 females, we used 60, 75, or 100 as possible values of K. For an initial population size of 88 females, we used 88, 110, and 147 as possible values of K. For an initial population size of 115 females, we used 115, 144 and 192 as possible values of K.

For the PVA we assumed build-out would occur gradually over a 50-year period and that the severity of impacts would increase, accordingly. Based on our analysis in SECTION 5.3.1.1 we determined habitat likely to be developed in the Development Envelope was enough to support 1 female panther home range, and that the loss of this habitat would result in the loss of 1 adult female to the population. To input this effect of habitat loss over a 50 year build-out into the PVA, we divided the maximum developable acreage by 50 years, and scaled 0 buildout to equal 1 female panther and full buildout to result in 0 female panthers in the Development Envelope after build-out was complete. We input this gradual change into the carrying capacity function of RAMAS Landscape by reducing overall carrying capacity by 1 female panther in annual increments, over the course of 50 years, to account for the impact of habitat loss on the panther population attributable to development proposed in the HCP.

In addition to habitat loss caused by development in the HCP, sea level rise (SLR) of 1m by 2070 is projected under NOAA's Intermediate-High, High, and Extreme Scenarios and the CARSWG Highest scenario (Noss et al. 2014, Hall et al. 2016, Sweet et al. 2017, USGCRP 2017, USGCRP 2018). SLR this magnitude will inundate 405,006 acres (18 percent) of the panther's current range (Figure 5-6, USFWS Draft 2020). Recent observations indicate SLR rise in the Southeastern United States, and South Florida in particular, is accelerating at a faster rate than previously estimated (Boon et al. 2012, Ezer 2019, Boon et al. 2018, VIMS 2020). If so, the amount of panther habitat lost through SLR may exceed 18 percent in 2070. Conversely, if steps are taken to reduce greenhouse gas emissions in the near future, the effects of SLR may be reduced. If so, the amount of panther habitat lost through SLR may be less than 18 percent in 2070. To input SLR in the PVA we assumed SLR would accumulate linearly and only to 1 m by 2070, and divided the acreage by 50 years with 0 acres lost to SLR being equivalent to a proportion of individuals represented by a given N_0 (see below), and to 18 percent of habitat loss to SLR being equivalent to 18 percent of N_0.

We next input these data into a commercially available platform (RAMAS Landscape) to incorporate and analyze the impact of the proposed action on the species. We replicated each possible N_0 and K combination 100 times, for a duration of the ITP (50 years) and 100 years beyond, and compared the probability of extinction and final population size (N_{150}) of the following three scenarios to one another:

- **Baseline with Future SLR (B_{SLR})**. A reduction in the carrying capacity (K) of Florida panther habitat by 1m of SLR forecast for 2070 (reduction in 405,006 acres or 18 percent all available habitat equivalent to K of 11 females where N_0=60, 16 females where N_0=88, and 21 where N_0=115). Otherwise, all other vital rates were held constant as estimated in van de Kerk et al. (2019).
- **B_{SLR} plus HCP Development Effects (B_{SLR}+HCP)**. The Baseline with Future SLR scenario with the following additional effects:
  - Panther highway mortality due to HCP-generated traffic in the Action Area increases as a function of panther population size and annual traffic volume (beginning with 0 mortality due to vehicle collisions from HCP-generated traffic in the present (no buildout) and incrementally

> The scenarios we compare under section 7 of the ESA and NEPA are different. Under NEPA, we compare the future with the project scenario (BSLR + HCP) to a future without the project scenario. This comparison is captured in our EIS document for the HCP. Under section 7 of the ESA, we compare the future with the project scenario (B_{SLR} + HCP) to the Baseline condition (B_{SLR}) to help us determine whether the effects of the action are likely to result in an appreciable decrease or increase in the probability of survival and recovery over time. In addition, under section 7 of the ESA, we consider the cumulative effects, and compare the future with the project and cumulative effects scenario (B_{SLR}+HCP+CE) to the Baseline condition (B_{SLR}) to help us determine whether the effects of the action along with other actions that are reasonably certain to occur in the future without consultation with the Service are likely to result in an appreciable decrease or increase in the probability of survival and recovery over time. We consider both of these comparisons when we make our jeopardy determination.

up to 5 additional females above present in year 2070 (at full buildout), where 5 is the maximum when N=K), assuming developments proposed in the HCP will have an internal trip capture rate of 50 percent (SECTION 5.2.2.4).

- The impact of increased traffic volume from the HCP are minimized by the construction of 8 wildlife crossings of 80 percent effectiveness in reducing panther/vehicle collisions within ¼ mile, on road segments with the highest mortality, from 5 to 4 females/year (A savings of 1 females/year from HCP generated traffic) (SECTION 5.3.1.4).
- The loss in carrying capacity from covered activities within the Development Envelope equivalent to 1 female/year in 2070 (the amount computed from the 300 m buffering analysis in SECTION 5.3.1.1). We simulated this by incrementally reducing K annually until it equaled 1 female in 2070.
- The loss of panthers from all other sources of mortality associated with proposed development in the HCP (1 female/year by 2070) (SECTION 5.3.1.3).
- The sum of the above effects (-5 +1 -1-1) equals a reduction of 6 females/year at full buildout from HCP related causes such as vehicle collisions in the Action Area, loss of habitat within the Development Envelope, and the loss of panthers to collisions with vehicles on new roads, illegal shootings, management action, increased interspecific aggression, and other causes.

- **B_{SLR}+HCP plus Cumulative Effects (B_{SLR}+HCP+CE)**. The B_{SLR} +HCP scenario with the following additional effects:
  - We project 2 females/year above present will be taken by traffic generated by non-HCP sources, that 1 of these will be saved due to crossings proposed by the applicants, leaving 1 female/year to be taken by non-HCP sources of traffic (SECTIONS 5.4.1 and 5.4.2)
  - The combined mortality from all sources (HCP and CE) will be equivalent to 7 females/year at full build-out (-5+1-1-1-1) (Table 5-10).

Lastly, as a tool for conservation planning we analyzed conditions under which change in abundance and viability would not statistically differ from baseline. Specifically, we ran PVA scenarios in which fewer or more panthers were taken per year at full buildout than estimated in our effects analysis. For these PVAs we assessed population abundance and viability when 4, 6, 8, 10, and 12 females were taken per year at full buildout.

5.5.3 Model Results

For each of the three scenarios above, we simulated a 150-year population trajectory (50-year build-out plus 100 years beyond) and compared the predicted change in population viability for the panther. Our PVA found that in the presence of sea level rise and current conditions (B_{SLR}), the average probability of extinction across all possible initial population sizes and carrying capacity combinations was approximately 1.1±0.8 percent, and that the population size at 150 years would average approximately 75 females, or 150 adults of both sexes. When we applied the effects of the action to this model (B_{SLR}+HCP), the average probability of extinction increased to 5.7±3.5 percent with an average final abundance of approximately 33 females, or 66 adults of both sexes. Lastly, when we added the impact of cumulative effects to the effects of the action (B_{SLR}+HCP+CE) the probability of extinction increased further to an average of 6.6±4.3 percent with an average final abundance of 32 females, or 64 adults of both sexes (Table 5-11).

As one means to evaluate whether the increase or decrease of the abundance and probability of extinction were significantly different compared with B_{SLR}, we ran a Moods Median Test. To ensure that this was the appropriate test, we consulted with a USGS statistician (Ross 2020b). B_{SLR} +HCP had a significantly different (higher) probability of extinction than B_{SLR} (P=0.004). Likewise, B_{SLR} +HCP+CE also had a significantly different (higher) probability of extinction than B_{SLR}+HCP (P=0.0001). Similarly, final abundance at the end of the time horizon analyzed (N_{150}) for B_{SLR} was significantly different (higher) than B_{SLR}+HCP (P = 0.0001), and B_{SLR}+HCP+CE (P = 0.0001).

The PVA output of final abundance 100 years after full build-out of the HCP is sensitive to scenario, initial population size (N_0), and initial carrying capacity (K_0) (P = 0.084, 0.002, 0.0001, Fully Nested ANOVA). Scenario explained 38.15 percent of the variance in final abundance, while N_0 and K_0, and error explained 33.09 percent, 17.8 percent, and 10.98 percent of the variance, respectively.

Lastly, we note our estimate of final panther abundance, at B_{SLR} (Baseline with SLR, Duration of ITP + 100 years) of 48, 75, and 100 females (96, 150, and 200 total adults and subadults), respectively, are not significantly different from the findings of van de Kerk et al. (2019) (95 percent CI of 142 –216 adults and subadults, Mood's Median Test, P = 0.414). van de Kerk et al. (2019) recommended repeating genetic introgression by releasing 5–10 individuals from other puma populations every 20–40 years. Because we assume the Service will implement this recommendation, we believe our PVA is consistent with the results of matrix PVAs performed by them that didn't contain genetic information.

Additionally, during the development of the panther SSA (USFWS Draft 2020) the Service estimated the effects of sea-level rise on the panther population reported by the van de Kerk et al. (2019) PVA. The results of our B_{SLR} scenario and the Service's estimates by other means for the SSA are similar. From this we conclude that we have captured the effects of SLR on habitat availability over the next 50 years in a reasonable manner that is consistent with the results that would have been obtained by van

Our estimated probability of extinction for B_{SLR}, 1±0.8 percent probability of extinction within 100 years of project completion (duration of proposed ITP + 100 years = 150 years beyond present), falls within the range predicted by van de Kerk et al. (2019) when genetic information isn't included (the cumulative quasi-extinction probabilities within 100 years were 1.4 percent (Individual Based Model (IBM); 0–0.8) and 1.3 percent (matrix model; 0–0.6) with probabilities increasing to 2.0 percent (IBM; 0–1.7) and 1.9 percent (matrix model; 0–1.6) within 200 years). If recommendations of introducing 5-10 individuals from other Puma populations every 20-40 years aren't adopted, van de Kerk et al (2019) predicted probability of quasi-extinction would increase to 13percent (0–99) at 100 years and 23 percent (0–100) at 200 years (Minimum Population Count Scenario) or to 10 percent (0–99) at 100 years and 12 percent (0–99) at 200 years (Motor Vehicle Mortality Scenario). If the van de Kerk et al. (2019) recommendations aren't adopted, it would mean our estimates of extinction probability and abundance would change similarly.

de Kerk et al. (2019), had they included information about habitat loss from SLR in their PVAs. Our results were also similar to van de Kerk et al.'s (2019) despite the fact their model did not consider the impact of sea level rise, while ours did. We infer from this result that SLR as we modeled it here does not influence probability of extinction as much as small population size and genetic variation might.

Finally, we modeled scenarios prefaced on the assumption the Applicants are able to further reduce the effects of their action (*e.g.,* "through adaptive management") or further minimize and mitigate them through use of the Marinelli Fund, as well as scenarios that included the possibility our effects analysis resulted in an underestimate of annual take at full buildout. This exercise found that whenever no more than 10 adult panthers (4 female adult panthers) per year were taken above present(from all causes) the probability of extinction falls from 5.7 percent to 1.4 percent, and that this latter result is within the confidence interval of population viability should not further development occur in the RLSA.

To confirm that our statistical comparisons were made using the appropriate statistical tests for the data we were comparing, we had our analyses peer reviewed by a statistician (Ross 2020b).

5.5.4 Uncertainty in the Analysis

We acknowledge our estimate of possible effects of the Action to panthers contains uncertainty. For example, whether the full effects we estimate are realized to the magnitudes described above, or not, significantly depends upon how the HCP is implemented by the Applicants and by external factors independent from the Applicants. To address unknowns, assumptions, and uncertainties, the Service and permittees will periodically review the action, and confer on adaptive management measures whenever necessary, in accordance with the process described in Section 2.2 of this Biological Opinion. By doing so we should have early warning of unexpected changes to the panther population and avoid the possibility of an appreciable reduction in population viability.

<u>Panther Monitoring and Impact Thresholds for Further Service Action</u>

Presently, the Service and FWC estimate the current range-wide population size of panthers is between 120 and 230 adults (FWC and Service 2017), while the range-wide mean and standard error of roadway mortality of panthers, from 2014 through 2019, is 28 ±1.51 individuals/year (11.33±0.72 females). Internal population viability analysis contingency modelling, and statistical comparison of possible thresholds found that the probability of extinction 100 years after ITP expiration of B_{SLR}, B_{SLR} + HCP, and B_{SLR} + HCP + CE scenarios do not differ significantly (1.38 percent Pr_{ext} versus the 1.1±0.8 percent Pr_{ext} estimated for B_{SLR}) if fewer than 10 adult panthers (4 female panthers) total are taken annually, above present. Over time it is likely this threshold will be modified as the panther population grows or declines. Whatever threshold is deemed appropriate at the time of the Service's review, the Service will take all actions within its authority to ensure the present viability and future recovery of panthers is not compromised by implementation of the HCP.

<u>Qualitative Assessment of the Beneficial Effects of the HCP</u>

As required by section 7 regulations, we also considered the potential for measures proposed in the ECMSHCP to further lessen/offset the impact of development to panthers under the RLSP. These measures include: delineation of development and preserve lands to minimize habitat loss and to maintain wildlife movement corridors, and project-level best management practices to minimize effects originating in the “Covered Activities Area” that might otherwise impact adjacent areas to be set aside for preservation. The ECMSHCP also identifies habitat restoration and enhancement needs for certain covered species. These habitat improvements, along with future wetlands mitigation, would likely occur on a local scale, either in preserve lands or on project sites, and in some cases would also benefit panthers. In addition to project-level actions, we considered how the creation of the Marinelli Fund might also benefit panthers.

Conservation measures will provide offsets to projected impacts, and the Marinelli Fund could result in substantial conservation lifts. Conservation measures for which we had data to evaluate quantitatively in the PVA are summarized in Table 5-12. Conservation measures for which we lacked sufficient data to include in the PVA are summarized qualitatively below.

The first benefit of the ECMSHCP is that it requires landowner participation in the RLSP as a condition of an ITP permit. This in itself provides a level of certainty about the extent and general placement of development that didn’t exist when participation in the RLSP was strictly voluntary. Specifically, of the 178,868 acres of the RLSA not in public ownership, ECPO owns 151,442 acres of these. Participation of ECPO landowners in the HCP (and by extension the RLSA) limits all development on these properties to a 45,000-acre maximum with no possibility of development at base zoning densities on the approximately 106,442 acres of remaining ECPO lands. This will largely preclude the possibility of approximately 180,000 acres of RLSA land being converted from their present use (predominantly agriculture plus 102,352 acres of native habitats used by panthers) to rural residential use. Incentives provided by Collier County also encourage the designation of the remaining 27,426 acres of non-ECPO lands as SSAs by requiring this designation to entitle the full 45,000 acres of rural compact development.

Yet this cap only applied to lands they own and this offered no protection from development on lands they don’t. This meant without changes to the RLSA the 45,000 acre cap proposed in the HCP would have only provided a maximum development footprint within approximately 78 percent of the RLSA (the 139,442 acres owned by the Applicants) but that further development could still have occur at any density within the 39,426 acres the Applicants don’t own (approximately 22 percent of lands within the RLSA). Recently, the Collier County Board of Commissioners approved Amendments to the RLSP, a step in the approval process that will make a 45,000 acre development cap apply to all properties within the RLSA and provide incentives to ensure these are the only acres developed within the RLSA. Requiring landowner participation in the RLSP ensures this 45,000-acre cap on total development in the RLSA will not be exceeded as long as the amendment makes it through the final approval process.

HCP participation and implementation by landowners also addresses specific recovery actions listed in the species recovery plan’s outline and implementation schedule. These include:

- Initiating and encouraging landscape-level HCPs where proposed non-Federal actions or projects will impact panthers or their habitat;

- securing Camp Keais Strand;
- securing a corridor between Big Cypress National Preserve and Okaloachoochee Slough;
- maintaining the spatial extent and arrangement of habitat on a landscape scale;
- securing habitat adjacent or contiguous to areas of high risk for panther/vehicle collisions
- Providing education and outreach to residents living in, and adjacent to, panther habitat

Use of the Marinelli Fund may also accomplish the following recovery actions listed in the recovery action outline and implementation schedule:

- Develop and expand funding mechanisms and other incentives for habitat restoration and,
- Secure funding for the installation of wildlife crossings and fencings in high risk areas or to retrofit roadways with wildlife crossings and fencing to promote connectivity and dispersal.

Specifically, the Marinelli Fund, is expected to be governed by the Marinelli Foundation Board consisting of 4 NGO partners, 2 ECPO representatives, and 1 at-large member selected by the other 6 board members. The Marinelli Foundation Board will focus its spending on actions that benefit panthers (ECMSHCP chapter 9.3). Possible actions include, but are not limited to, the construction of additional wildlife crossings, habitat acquisition for preservation, habitat restoration, habitat improvement, habitat management, public outreach, education, and research. The fund has the potential to generate in excess of $150 million through 2050 with revenues deriving from the sale and resale of residential housing, and voluntary donations (PRT 2009). This program, if it achieves these levels of funding, is likely to facilitate substantial benefits towards the conservation and recovery of the panther. However, without specificity regarding the number and location of improved acres, and the original and final condition of those acres, we are unable to quantify the amount of improvement and the conservation benefit for species. That said, we fully acknowledge that habitat improvements will have benefits on species and ecological functions and that these benefits are more likely to be realized under the HCP than other scenarios. A notable exception to this quantification difficulty is the inclusion of 8 wildlife crossings in the PVA based on the applicants' commitment to allocate $12.5 M of the first $13 M if the Marinelli Fund for this purpose. Even in this instance, because we were required to make assumptions on the number, location, and effectiveness of wildlife crossings, we may have over- or under-estimated the amount of offset for panthers.

Finally, the HCP also creates a framework for regular review of individual project proposals, impacts, and conservation measures whether or not they would otherwise be subject to consultation with the Service under Section 7(a)(2) of the Endangered Species Act. Specifically, developments pursued in accordance with the HCP will be checked to ensure best management practices and conservation measures proposed in the HCP are implemented at project-specific levels. Furthermore, as best management practices evolve, the regulations allow the Service to update and negotiate the inclusion conservation practices used at project-levels with ITP holders during project-level reviews. Lastly, the HCP provides a framework for ongoing collaboration between ITP holders, the Service, and other stakeholders in involved in panther conservation.

5.5.5 Tables and Figures

Table 5-11. The probability of extinction and predicted population size of the Florida panther under Baseline with Future Sea Level Rise (B_{SLR}), B_{SLR} plus HCP Development Effects (B_{SLR}+HCP), and B_{SLR}+HCP plus Cumulative Effects (B_{SLR}+HCP+CE) scenarios given three different beginning female panther population sizes. B_{SLR} = Baseline (Current conditions + 1m SLR by 2070) and the end time is 100 years after HCP full build-out in 2070.

N_0	B_{SLR}		B_{SLR} + HCP		B_{SLR} + HCP +CE	
	P_{ext}	N_{150}	P_{ext}	N_{150}	P_{ext}	N_{150}
60	0.027	48	0.121	18	0.15	16
88	0.004	75	0.042	32	0.037	32
115	0.001	100	0.0008	50	0.012	47
Average	**0.01**	**75**	**0.057**	**33**	**0.066**	**32**

Table 5-12. ECMSHCP conservation measures included in the PVA.

Effect Component of PVA	Effect in PVA	Delta female panthers at N_0=60	HCP-attributable reductions in panther loss described in PVA[a]	Location in BO
Baseline	SLR	-11	NA	5.5.2
HCP	HCP-generated traffic	-5	50% internal capture led to fewer panthers killed on roads	5.2.2.4
HCP	HCP funded underpasses	1	8 underpasses reduced road mortality	5.3.1.4
HCP	Loss in carrying capacity	-1	Preserve/VLD areas reduced the loss of carrying capacity	5.3.1.4
HCP	All other sources	-1	Lighting, pet/pesticide restrictions, etc. reduced the loss of panthers to "other sources"	5.3.1.3
Cumulative	Non-HCP-generated traffic	-2	NA	5.4
Cumulative	HCP funded underpasses	1	8 underpasses reduced road mortality from both the HCP- and non-HCP attributable traffic	5.5.2

a. Without these measures, the change in female abundance would be greater than listed in "Delta female panthers at N_0=60".

5.6 Conclusion for Florida Panther

In this section, we summarize and interpret the findings of the previous sections for the panther (status, baseline, effects, and cumulative effects) relative to the species-specific purpose of a BO under §7(a)(2) of the ESA, which is to determine whether the proposed action is likely to jeopardize the continued existence of a species. This analysis is a weight of evidence approach that includes both quantitative and qualitative estimates of both impacts, offsets, and beneficial effects of the action.

Status

Panthers are opportunistic predators that consume primarily white-tailed deer, feral hog, raccoon, and nine-banded armadillo. However, panthers will opportunistically select other prey when these are not available. Panthers prefer forested landscapes with sufficient edge habitat, and habitats within 300 m of forested habitat in proportion of availability. Panthers are polygynous. Female panthers establish home ranges in proximity of closely related females, while males compete for territories that overlap the ranges of several females. When suitable home ranges are strongly contested or unavailable, juvenile males and females may disperse great distances in search of alternative areas.

FWC documented a female panther north of the Caloosahatchee River for the first time in over 40 years in 2017. Subsequent documentation of additional female(s) with kittens create optimism that the South Florida population will expand their breeding range to include areas north of the Caloosahatchee River in the future. However, as of June 2020, there is no evidence that successful recruitment, i.e., offspring born and surviving to enter the breeding population as adults, has occurred north of the Caloosahatchee River (Kelly and Onorato 2020), and until that evidence is documented, we do not conclude that the breeding range of Florida panthers has expanded beyond South Florida (USFWS 2020).

Panthers in the Action Area face the same threats as those listed range wide. Specifically, panthers in the Action Area face impacts from human disturbance, and human-caused habitat loss, fragmentation, and degradation from residential development, commercial development, and climate change. Sources of human-caused mortality in the Action Area, such as collision with motor vehicles, illegal shootings, and increased exposures of panthers to disease and pollution also threaten growth of the panther population. Additionally, as the human and panther population both grow incidences of human-panther conflict may also occur to the detriment of panthers. Lastly, panthers confront many ecological challenges, such as genetic risks associated with small population size or declines in prey populations caused by natural processes or human activity.

Conservation needs that address the most substantial threats listed above include the following.

(a) to conserve remaining panther habitat, restore new panther habitat, and enhance existing habitat to support growth of the population and the range of panthers;
(b) Maintain a permeable landscape that provides connectivity between existing habitat;
(c) to reduce mortality from anthropogenic sources; and
(d) to ensure genetic variation remains sufficient to minimize the potential impact of inbreeding depression on survival and recovery.

Baseline

Documented use of the Plan Area by panthers is extensive. Panther observations within the Plan Area make up 10 percent of the record of all panther observations in the wild. Approximately 36 percent of all panthers tracked by radio telemetry have been documented as using some portion of the Plan Area. Thus, we conclude it is likely between 10 percent and 36 percent of the panther population may use a portion of the Plan Area at some point in their lifetime, even if only transiently. The Plan Area contains 102,352 acres of habitat used by panthers for feeding, breeding, sheltering, or dispersal. Plan Area conservation needs and threats parallel the range-wide needs and threats.

Van de Kerk et al. (2019) found that individual-based population models predicted that the probability that the population would fall below 10 panthers within 100 years (quasi-extinction) was 1.4 percent, but when the effect of genetic erosion was considered, the probability of quasi-extinction within 100 years increased to between 13 and 17 percent. They also found that when genetic introgression was implemented every 10 years via the translocation of 5 females from Texas populations of *Puma concolor* to South Florida, the probability of quasi-extinction fell from 13 to17 percent to a range between 6 and 10 percent.

<u>Effects</u>

When quantifying the effects of the action, we had to make a series of assumptions, and address uncertainties. In doing so we used information and data as presented in the HCP as required under section 7 regulations at 402.14(g)(8). We selected data (or a data range) that was consistent with other published or accepted literature. We avoided using "best case" or "worst case" scenarios in an effort to provide a thoughtful, reasonable assessment of the effects. When we were unable to quantify the effects of the action, we provided a qualitative assessment and described the range of uncertainties whenever possible.

Proposed development and mining in the Plan Area include various activities that will permanently eliminate up to 18,337 acres of panther habitat if forest cover is developed last, but could take up to 30,616 acres of habitat if forest habitat in the covered activities, base zoning, and lands eligible for inclusion are taken first. Because the HCP states that one of the goals of the plan is to avoid development in panther habitat, we assume the best available panther habitat will be avoided during development and that the equivalent of 3 panthers/year will be lost at full buildout.

The designated Preservation areas of the HCP contain 69,342 acres, or 69 percent, of forest cover and habitats within 300 m of it in the Plan Area that we consider likely panther habitat. The Applicants propose to preserve existing habitats, and to potentially restore, enhance, or create such habitats to mitigate for permanent losses associated with the Covered Activities. The HCP does not specify performance measures (amount or extent, functional gain) for such restoration and enhancement activities. Nonetheless, at minimum we do not expect the proposed management of Preservation areas to reduce the numbers, reproduction, or distribution of the panther in the Preservation areas, because these activities would at least maintain current conditions. Special attention to this species in the long-term management of the Preservation areas under conservation easements and habitat restoration could increase the number of panthers the Plan Area supports, though. For example, restoration of 17,605 acres of agricultural lands to forest cover in the Preserve area could boost the Plan Area population by the equivalent of 3 panthers, annually. Thus, habitat restoration on this scale could fully offset the impact of habitat loss from proposed development. However, though the HCP makes allowance for the possibility of habitat restoration, the HCP does not explicitly propose habitat restoration of this scale.

The HCP mentions wetland restoration and habitat mitigation for other species will occur in the Preservation areas. Because locations and types of restoration are not described, we are unable to determine if the changes will be beneficial for panthers.

The Very Low Density use areas of the HCP contain 2,394 acres of panther habitat. Development of some portions of these for residences, lodges, hunting/fishing camps could reduce such habitat by up to 239 acres, but we do not expect significant adverse consequences to panthers resulting from such displacement.

We also estimate up to 1 panther may be lost annually from other effects of HCP proposed development, such as panther mortality on new roads, management removal to address human/panther conflict, new exposure to disease and toxins, and sub-lethal and lethal effects of declining prey populations (such as intra- and inter- specific aggression and malnutrition).

Additionally, assuming communities proposed in the HCP have a 50 percent internal capture rate, and that the Applicants will facilitate the construction of 8 wildlife crossings, and these crossings are at least 80 percent effective in reducing roadway mortality, we estimate traffic volume generated from the HCP on existing roads will take 8 more panthers/year than present.

In summary we expect development proposed in the HCP to lead to the taking of 8 panthers per year above present from collisions with motor vehicles on existing roads, the equivalent of 3 panthers/year from the reduction in habitat, and 1 panther/year from all other causes for a total of 12 panthers/year above present at full buildout.

Cumulative Effects

Traffic on public roads, which is the sole source of cumulative effects we have identified for this Action, is likely to take up to 2 panthers/year above present in 2070 if developments contributing to projected 2070 traffic levels that will likely not consult with the Service (about 25 percent of projects) take no action to avoid, minimize, or mitigate their effects.

The cumulative effects (2 panthers/year) and the effects of the HCP (12 panthers/year) combined will result in the taking of 14 panthers above present levels/year at full buildout.

PVA

The results of our baseline PVA are consistent with the results of the van de Kerk et al. (2019) PVA. Simulation results with the effects of Sea Level Rise, the effects of the HCP, cumulative effects, and the combination of these added to the baseline predict the presence of development proposed in the HCP will result in a smaller population size: from an average of ~150 adults persisting 100 years after expiration of the ITP under baseline conditions to an average of ~64-66 adults when the effects of the HCP and cumulative effects are added. The results of our simulations also found a lower probability of persistence when the effects of the action and cumulative effects are added to the baseline: from a baseline average of 1±0.8 percent probability of extinction (B_{SLR}) to 5.7±3.5 percent (B_{SLR} + HCP) and 6.6±4.3 percent (B_{SLR} + HCP + CE) 100 years after full implementation of the actions proposed in the HCP and manifestation of cumulative effects, respectively. Additionally, our analysis of conditions under which change in abundance and viability would not statistically differ from baseline found that if the Applicants are able to further reduce the effects of their action (*e.g.*, "through adaptive management") or mitigate them through use of the Marinelli Fund such that the net effect is a loss no more than 10 adult panthers (4 female adult panthers)/year above present (from all causes) the probability of extinction falls from 5.7 percent to 1.4 percent. This latter result is not statistically different from scenarios in which no further development occurs in the RLSA.

Because we do not have evidence that kittens produced by female panthers north of the Caloosahatchee River have survived to an age where they can contribute to population growth, the PVA was based on a closed population south of the River. It is likely over the 50-year course of the HCP and the additional 100 years modeled by the PVA that a breeding population will be established north of the River. If expansion occurs and all else remains as input into the PVA, then the effect would be to lessen the negative influence of the HCP on the panther population by increasing the overall abundance and reducing the probability of extinction.

Effects on Recovery

Implementation of the HCP could substantially contribute towards the first Recovery Objective listed in the Florida Panther Recovery Plan (2008), which is to "To maintain, restore, and expand the panther population and its habitat in south Florida and expand the breeding portion of the population in south Florida to areas north of the Caloosahatchee River." Specifically, the required participation of ITP holders in the RLSP ensures the protection of 69,342 acres of habitat frequently used by approximately 27.6 ±5.81 panthers. These panthers use this habitat for home ranges or linkages between areas of habitat suitable for use as home ranges. Other recovery actions that are advanced by the HCP include: initiating and encouraging landscape-level HCPs where proposed non-Federal actions or projects will impact panthers or their habitat; securing Camp Keais Strand; securing a corridor between Big Cypress National Preserve and Okaloachoochee Slough; maintaining the spatial extent and arrangement of habitat on a landscape scale; and securing wildlife crossings with habitat adjacent or contiguous to crossings in areas of high risk for panther/vehicle collisions.

These qualitative benefits from the HCP are not immediately quantifiable but may be able to be quantified in the future. Regardless, they likely also provide administrative, analytical, or other efficiencies in both the short and long term. While these benefits or offsets may not be species specific, most provide some direct or indirect conservation for panthers. These are summarized in Table 5-13. Qualitative benefits are considered in addition to those we were able to quantify when conducting our jeopardy analysis.

Table 5-13. Comparison of project by project consultation vs the programmatic HCP approach.

Project-by-Project (Without HCP)	**With HCP**
Project-by-project review and authorization via section 7 exemption or section 10 ITP	Programmatic authorization, via section 10 ITPs, of projects within limits prescribed by HCP
Repeated negotiation/consultation, permit actions for each project	Project consistency check. Partial permit transfer to project-specific developer
Mitigation based in RLSP, negotiated, planned project-by-project, traffic effects negotiated, planned, and funded project-by-project	Mitigation, as based in RLSP, defined across the HCP area, project-specific BMPs, traffic effects addressed via Marinelli Fund and via cooperative framework of check-ins. Effects addressed via Marinelli Fund, cooperative framework of check-ins, and the option of course corrections.
Layout of RLSP sending areas would result in habitat corridors.	Proposed HCP habitat corridors expand on the RLSP sending areas adding assurance of functional corridors in perpetuity. Estimate an additional 26,000 acres of habitat conserved under HCP compared with RLSA only.
Range-wide initiatives are needed and are an appropriate way for landowners to participate with other panther stakeholders to address jointly-responsible impacts to panthers.	Range-wide initiatives like the Marinelli Fund would be more certain under the HCP. Periodic check-ins provide a new venue for ECPO and other stakeholders to cooperate on conservation issues.
Habitat corridors and crossing sites could be planned on a regional basis (*e.g.,* Wild Blue corridor), but would be built one-by-one [independently, individually, piecemeal].	Habitat corridors and crossing sites identified up front, funded and installed commensurate with development area. Coordinated plan, certainty of region-wide conservation planning, framework for cooperation with other stakeholders, provides a framework to build cooperation among panther stakeholders.
In the current individual project approach, effects analysis, including jeopardy, would be repeated.	Programmatic approach consolidates impacts analysis and permitting to one action versus

A threshold of jeopardy may be reached beyond which no new actions could be contemplated or permitted.	numerous individual actions accumulating through time. Under the proposed programmatic approach, an expedited individual project review, consistency check, would occur and serve the same function to alert of an impending threshold of jeopardy.
Project-specific conservation lands are often committed up front and protected with a conservation easement, management plan, and management funding in perpetuity, but are smaller in size because they are only for the one project. Lands of less value to panthers are rarely included in conservation lands offered by applicants. Potential future conservation lands (opportunities) could be lost before obligated as mitigation for a specific project if they are converted to agriculture, used for a project that does not require section 7 consultation and did not consult under section 10, or part of a section 7 consultation that does not offer compensation. Cost of management for preservation lands born by property owners rather than by public agencies or easement holders. Land that is conserved is at no cost to public of conservation lands, public conservation money can go to other objectives.	Range-wide preservation lands obligated by permit condition, not at risk of competing land uses. Conservation easements are placed on preserves as part of individual project approval. It is unclear if a management plan will be created. Lands of lesser value are included in the preserve areas. Cost of management for preservation lands born by property owners rather than by public agencies or easement holders. No cost to public of conservation lands, public conservation money can go to other objectives.
Covered species determined project-by-project. All listed species on or in the vicinity of a project are considered. Species identified as at-risk by the Service are considered, but there are not many in the HCP area. Because projects are smaller in size than the HCP, there are generally fewer	Many covered species addressed, long term planning for species that are not normally addressed in [project review] regulatory planning.

considered per consultation. State-listed species are not considered.	
County RLSP delineates high-density development areas, cumulative impacts (including Ave Maria) of 45,000 acres throughout 71,000 acres of open lands.	High-density development area consistent with, and more limited than, RLSP (reduced development envelope of 49,000 acres). Cumulative impacts (including Ave Maria) of 45,000 acres.
	Designates the Summerland Swamp landscape linkage as a Preservation Area (currently RLSA Open Lands), providing additional panther habitat protection and improved landscape functionality.
Planning crossings complicated if different ownerships involved.	Cooperation among permittees built-in, can plan crossings across ownerships. Secures landscape linkages that will preserve functionality of FDOT-planned wildlife crossings on SR82 and connect existing conservation lands in the Plan Area (e.g., CREW) to designated conservation and agricultural lands in Sector Plans proposed in Hendry County.

Opinion

Measures included in the HCP have the potential to aid in accomplishing several recovery actions listed in the Florida Panther Recovery Plan (3rd edition 2008). These could aid in maintaining the overall quality, quantity, and functionality of habitat within areas of the Plan Area, ensure that equivalent habitat protection and restoration are provided, and compensate for both the quantity and functional value of the lost habitat. Additionally, measures proposed in the HCP meet recovery actions of securing Camp Keais Strand to maintain connectivity from Florida Panther National Wildlife Refuge to Corkscrew Regional Ecosystem Watershed; securing a corridor between Big Cypress National Preserve and Okaloachoochee Slough; maintaining the spatial extent and arrangement of habitat on a landscape scale; and securing wildlife crossings with habitat adjacent or contiguous to crossings in areas of high risk for panther/vehicle collisions.

Best management practices proposed in the HCP also encourage habitat management on private lands to adequately provide for panthers and their prey; provide incentives and assistance to willing landowners to manage their lands for panthers and their prey using tools such as prescribed fire and invasive plant control, and provide incentives that encourage them not to convert a portion of their lands to less suitable habitat. Measures proposed by the Applicants may also minimize and prevent injuries and mortalities by modifying conditions on existing roads and implement appropriate actions to protect panthers during the planning, permitting, and construction of new roads and highway expansion projects, and facilitating the securing of funding for the installation of wildlife crossings and fencing in high risk areas.

However, the benefits of HCP proposed measures must be balanced against the demographic effects of the action on the population. Specifically, the loss of approximately 18,337 acres of panther habitat will reduce range-wide carrying capacity by the equivalent of ~3 panthers, annually at full buildout. Converting the majority of cropland in the Preserve Area to forests could offset most if not all of this impact, but such enhancement is not explicitly proposed or guaranteed within the HCP. Additionally, the loss of 1 additional panther/year at full buildout is predicted from other causes (such as mortality on new roads, reduction in prey habitat, increased exposure to disease and toxins, increased likelihood of management intervention to address depredation and human/panther conflict etc.). The applicants have committed to an adaptive management strategy that includes some BMPs that will partially address some of these threats. For the purpose of our analysis, we assumed communities built in accordance with the HCP will maintain a 50 percent rate of internal capture; the applicants will facilitate the construction of at least 8 wildlife crossings; and that the wildlife crossings will be 80 percent effective at reducing mortality. We also assumed the panther population would remain at, or greater than, its current size until impacted by development projected by the HCP. Based on these assumptions and considering the conservation measures proposed by the Applicants, we estimate traffic attributable to HCP associated development will increase the rate of panther mortality by up to 8 panthers/year (at full build-out) above the present rate.

We additionally recognize that increasing traffic on roadways from development proposed in the HCP will extend across much of the panther's present range and these increases will increase the effect of roadways as barriers to movement to panthers and may intensify the effects of habitat fragmentation. We acknowledge measures proposed by the applicants to maintain existing corridors and construct additional wildlife crossings will reduce the impact of roadway mortality and habitat fragmentation.

We were only able to partially quantify the conservation measures in demographic terms that could be incorporated into our traffic or PVA models. This is a result of both the adaptive nature of many of the conservation measures (i.e., because we do not know where or when the measure(s) will be implemented they are not currently quantifiable) and assumptions built into the PVA. As a result, we cannot demonstrate a full offset of the predicted effects of traffic and development expected from the activities described in the HCP. For example, a likely total mortality of panthers from development proposed in the HCP (12 individuals above present) remains after panther/vehicle mortality has been reduced by 6 panthers/year because of the construction of 8 additional wildlife crossings (built using Marinelli Funds) with 80 percent efficacy, and maintenance of an internal capture rate of at least 50 percent in newly built communities. It is possible the construction of additional wildlife crossings, fencing, acquisitions, as well as habitat restoration and management facilitated by the Marinelli Fund could offset much, if not most or all, of these predicted effects. Other proposed Marinelli Funded conservation measures are not quantifiable at this time. For example, habitat is proposed to be managed in a way that increases the value for panthers. At this we do not know how many acres may be improved, to what extent the habitat value may be increased, or where on the landscape those improvements might be made. Undoubtably such actions will reduce the overall predicted effect of the Action, but the magnitude of the reduction is unknown and cannot be included in the PVA at this time.

The HCP's requirement of landowner participation in the RLSP for an ITP to cover their proposed development creates certainty around the future of development in the RLSA and guarantees protection of habitat necessary for the recovery of the panther. The establishment of the Marinelli Fund through implementation of the HCP creates additional benefit to panther recovery that exceeds the substantial benefit conveyed through landowner participation in the RLSP. However, our effects analysis is predicated on the assumption that community (internal) trip capture averages 50 percent at full build-out. Because we were required to make assumptions on the number, location, and effectiveness of wildlife crossings, we may have under- or over-estimated the amount of offset for panthers.

Additionally, our PVA indicates the implementation of the HCP, in the absence of further actions to reduce the impact of the action to the panther, will reduce the abundance of panthers across their range such that the probability of extinction is predicted to increase from 1 percent (95 percent C.I. 0.2 to 1.8 percent) to 5.7 percent (95 Percent C.I. 2.2 to 9.2 percent). When cumulative effects are added to the effects of the HCP the probability of extinction further increases to 6.6 percent (95 percent C.I. 2.3 to 10.9 percent). The probability of extinction after implementation of the HCP is statistically significantly different than baseline conditions. If the Applicants are able to achieve a greater than 50 percent community (internal) capture rate, further reduce the effects of their action, or mitigate them through use of the Marinelli Fund for habitat restoration to the extent that the net effect is a loss of no more than 10 adult panthers (4 female adult panthers)/year above present (from all causes) our analysis finds the probability of extinction falls from 5.7 percent to 1.4 percent. This probability of extinction is within the 95 percent C.I. of scenarios where no additional panthers are taken above present (i.e., not significantly different from baseline).

Based on our analysis of all factors influencing the effects of the action on panthers we conclude this further net reduction of effects to fewer than 10 panthers per year at full build-out will/will not be accomplished through the maintenance of high community (internal) trip capture, adaptive management, and the mitigative effects of actions facilitated by the Marinelli Fund. Thus, we conclude the proposed action is/is not likely "...to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild" (50 CFR §402.02).

After reviewing the status of the species, the environmental baseline for the Action Area, the effects of the Action and the cumulative effects, it is the Service's biological opinion that the Action is/is not likely to jeopardize the continued existence of the panther.

6 Big Cypress Fox Squirrel

This section provides the Service's conference opinion of the Action for the Big Cypress fox squirrel.

6.1 Status of Big Cypress Fox Squirrel

This section summarizes best available data about the biology and current condition of the Big Cypress fox squirrel (*Sciurus niger avicennia*; BCFS) throughout its range that are relevant to formulating an opinion about the Action. At this time, the BCFS is not protected under the ESA. The Service has not reviewed the species' status relative to the ESA definitions of "endangered" and "threatened." The State of Florida protects the BCFS as a threatened species under its Endangered and Threatened Species Rule. For purposes of this Conference Opinion, we summarize the *Species Action Plan for the Big Cypress Fox Squirrel* (FWC 2013), the *Species Conservation Measures and Permitting Guidelines for the Big Cypress Fox Squirrel* (FWC 2018), and other available data to describe the species' status.

6.1.1 Species Description

The BCFS is a large tree squirrel that is highly variable in color and patterning. The most common pattern includes a black head and dorsal fur, buff sides and belly, buff and black tail, and white nose and ears. Darker and lighter color patterns have been documented as well. The BCFS is the smallest of the four eastern fox squirrel subspecies that occur in Florida.

6.1.2 Life History

Although considered a tree squirrel, the BCFS spends a lot of time on the ground. The BCFS diet consists of a variety of seeds, nuts, fruits, berries, flowers, insects, and fungi that vary in seasonal availability. Cypress trees support most documented nests, with some in pines and cabbage palms. Nest materials are variable, but most consist of bark stripped from cypress placed on sticks or bromeliads.

Fox squirrels can mate at any time of the year, but BCFS have two breeding seasons: winter/dry season, from December to April, and summer/wet season, from July to October. Females generally mate with more than one male and the average litter size is typically 2 or 3 offspring. Gestation is about 6 weeks and weaning around 12 weeks after birth. Pups may remain with their mother through their first winter before dispersing. FWC (2011) reported that BCFS captured in Naples and released in Big Cypress National Preserve exhibited inconsistent site fidelity and movements of up to 32 km (about 20 miles) from the release locations.

BCFS use a variety of habitats including tropical hardwood forest, live oak forest, mangrove forest, cypress swamp, pine flatwoods, pastures, parks, and golf courses. In urban environments, BCFS use parks and golf courses where large trees and food sources are retained and the groundcover is open and low. Food availability significantly influences the size of the area used by BCFS, especially by females. In natural areas, mean home range size is 187 acres for males and 26 acres for females. Individual home ranges typically overlap substantially without observed territoriality; however, adults, especially females, often defend a core area of approximately 3 acres. The difficulties of surveying cypress swamps and gaining access to private ranchlands have constrained the collection of BCFS distribution and abundance data. Available density estimates are 0.09 and 1.92 squirrels/km^2 (3.6 and 78 squirrels/10,000 acres) in cypress swamps and wooded ranchlands, respectively (FWC 2011).

6.1.3 Numbers, Reproduction, and Distribution

The BCFS occurs in the southwestern tip of peninsular Florida, where FWC (2011) reports an area of occupancy of 1,677–3,840 km^2 (414,396–948,885 acres), and an estimated abundance of "well below" 10,000 squirrels. Applying the density estimates cited in the previous section to this range of occupancy estimates yields a population range of 151–7,373 squirrels, but FWC considered the population size greater than 1,000 mature individuals in its 2011 Biological Status Review Report. The status of BCFS in the core of the species' range, Big Cypress National Preserve and the Everglades, is largely unknown, but is considered declining due to extirpation from several historically occupied locations. FWC (2011) estimated a zero probability of BCFS extinction in the next 100 years, but a 50% probability of a 95% population decline in the next 100 years.

6.1.4 Conservation Needs and Threats

The BCFS requires areas with open ground cover and mature trees for food availability and nests. Habitat loss, degradation, and fragmentation are the main threats. Rapid urbanization in western Lee and Collier counties has isolated local BCFS populations within fragmented habitat patches. An insufficient use of prescribed fire has contributed to a degradation of BCFS habitat conditions on some conservation lands and private rural lands. In urban areas, mortality due to vehicles, pets, and other causes (*e.g.*, feeding squirrels with inappropriate human foods, exposure to rodenticides and other toxic chemicals) is a growing concern. Munim (2008) documented 10 BCFS road-kills in suburban areas in 2006–2007. Loss of native bromeliads (used as nest sites) caused by a non-native weevil, and various diseases, pose threats of an unknown magnitude to BCFS. The species' primary conservation need is the protection and management of open understory woodlands. FWC (2018) provides recommendations to address this need and others in its *Species Conservation Measures and Permitting Guidelines for the Big Cypress Fox Squirrel*.

6.2 Environmental Baseline for Big Cypress Fox Squirrel

This section describes the current condition of the BCFS in the Action Area without the consequences to the listed species caused by the proposed Action.

6.2.1 Action Area Numbers, Reproduction, and Distribution

The Plan Area contains 63,849 acres of land cover classes that may provide BCFS habitat, including forested wetlands, forested uplands, rural open lands, and improved pasture (Table 2-1). The Applicants did not conduct BCFS surveys of the Plan Area during the development of the HCP. The Biological Assessment for the 4,000-acre Rural Lands West Project, which is within the Plan Area, documented one BCFS on site in 2008 (Passarella & Associates, Inc. 2017). A University of Florida and FWC web-based survey of the public and natural resource professionals (August 2011–April 2012) received reports of 3 BCFS sightings within the Plan Area and of about 100 sightings on lands within 25 miles of the Plan Area (FWC 2013).

Based on these reports, the species' ability for relatively long-distance movements, and a substantial acreage of habitat types associated with the species, we are reasonably certain that BCFS occupy the Plan Area. We have no data that indicates the Plan Area supports a disproportionate share of the range-wide population, which does not occur at high densities anywhere. The lack of historic records in the Plan Area suggests a relatively lower density and patchy distribution. Lacking abundance data specific to the Action Area, we conservatively use the average of the densities reported for BCFS in cypress swamps and wooded ranchlands (40.8 squirrels/10,000 acres) to estimate that the Plan Area supports about 260 BCFS.

6.2.2 Action Area Conservation Needs and Threats

The range-wide conservation needs and threats we described in section 6.1.4 are relevant in the Action Area. With respect to the threat of exposure to toxic chemicals, at least three eastern grey squirrels have died of suspected rodenticide poisoning in Collier and Lee counties since 2011 (J. Fitzgerald, von Arx Wildlife Hospital, personal communication).

6.3 Effects of the Action on Big Cypress Fox Squirrel

This section describes all reasonably certain consequences to the BCFS that we predict the proposed Action would cause, including the consequences of other activities not included in the proposed Action that would not occur but for the proposed Action. Such effects may occur later in time and may occur outside the immediate area involved in the Action.

6.3.1 Development and Mining, Base Zoning, and Lands Eligible for Inclusion

The BCFS uses many land cover classes and most commonly uses forested wetlands for nesting. These characteristics are consistent with our criteria for applying the Proportional method described in section 2.1.4 to estimate the spatial extent of development impacts. By this method, we estimate that development and mining activities within the development envelope of the Plan Area would result in the loss of 9,284 acres of suitable habitat for the BCFS (the sum of acreages in Table 2-3 column "G" for those cover classes associated with the BCFS).

FWC (2018) permitting guidelines for the BCFS do not require pre-construction surveys, because it is difficult to locate BCFS nests, and the Applicants do not propose such surveys. Where BCFS nest or shelter within a construction footprint, the use of heavy equipment to remove vegetation and grade land surfaces during the construction (horizontal) phase of development activity (see Table 2-5) is likely to kill or injure most pups in nests and an undeterminable percentage of adult BCFS.

BCFS occupy areas year-round. Female BCFS forage within a 575-foot radius (24 acres) of their nests. Habitat modification resulting in a loss of more than 25% of plants providing food resources, more than 10% of trees providing other potential nest sites, or that alters the timing, quantity, or quality of water availability, would impair essential foraging and nesting behaviors

(FWC 2018). Such modifications are likely to displace entirely or shift the home range of individuals that avoid death or injury caused by construction activity. Displacement would expose individuals to an increased risk of predation, roadkill, and other lethal/injurious hazards during dispersal. Human habitation of the developed areas following construction would introduce various stressors that increase the risk of death and injury caused by pets, pesticides, and vehicles on roads. Due to the relative abundance of BCFS habitat in the Plan Area and low densities, a percentage of animals displaced by construction activity would survive and persist in adjacent areas, but we are unable to estimate this percentage.

By the direct and indirect effect pathways described in the previous two paragraphs, and using the average of reported BCFS densities (40.8 squirrels per 10,000 acres, see section 6.2.1), we expect an estimated 9,284 acres of development of BCFS habitat to harm up to 38 BCFS.

6.3.2 Preservation Activities

The designated Preservation areas of the HCP contain 47,811 acres of land cover that we consider as BCFS habitat (Table 2-1), including 11,550 acres of cypress forest and 7,599 acres of improved pasture (the two most extensive cover classes). Using the average of reported BCFS densities (40.8 squirrels per 10,000 acres, see section 6.2.1), we expect the Preservation areas to support about 195 BCFS. Activities in these areas would include prescribed burning, mechanical control of groundcover, mechanical and chemical control of exotic vegetation, and other activities that maintain or improve land quality and existing agricultural uses.

Although many of these activities maintain habitat for BCFS, some can also kill, injure, or disrupt the normal behaviors of BCFS that are present at the time. For example, prescribed burning maintains open ground cover that BCFS require for foraging. Burning may also cause squirrels to leave the burn zone or take refuge in their nests, which temporarily disrupts feeding behavior, and may kill or injure some squirrels through heat or smoke inhalation. Nests and nest trees may be destroyed during prescribed burns or by heavy equipment during exotic vegetation control; however, we consider these events rare and discountable.

The activities described above are a continuation of current land management practices, which we do not expect to alter the numbers, reproduction, or distribution of the BCFS in the Preservation areas. BCFS would experience occasional disturbances from land management practices conducted near nest trees.

We expect BCFS to persist in the Preservation areas, because the preservation and management activities under the HCP will, at minimum, maintain current conditions. Special attention to this species in the long-term management of the Preservation areas under conservation easements could increase BCFS densities and the Plan Area population. However, lacking more detailed information about BCFS in the Plan Area, and about how habitat management under easements may specifically benefit this species, we are unable to reasonably estimate the extent of potential BCFS benefits.

6.3.3 Very Low Density Development

The Very Low Density (VLD) use areas of the HCP contain 1,561 acres of land cover that we consider as BCFS habitat (Table 2-1), including 357 acres of freshwater forested wetlands and 502 acres of improved pasture (the two most extensive cover classes). Using the average of reported BCFS densities (40.8 squirrels per 10,000 acres, see section 6.2.1), we expect the VLD areas to support about 6 BCFS.

Land uses in the VLD areas are similar to the Preservation areas, but may also include isolated residences, lodges, and hunting/fishing camps, at a density of no more than one dwelling unit per 50 acres. Croplands and orchards are not present in the VLD, but the Applicants would continue current ranching/livestock operations and other management activities as described for the Preservation Areas (*e.g.,* exotic species control, prescribed burning). As in the Preservation areas, we expect any adverse effects resulting from the continuation of the existing land management regimes as rare and discountable.

The HCP does not specify a footprint for the isolated residences, lodges, and hunting/fishing camps, but indicates that their construction could clear up to 10% of the existing native vegetation (see section 2.5). New dwelling development could occur within any of the cover types present besides open water and existing development. Clearing up to 10% of the cover types that we consider as BCFS habitat would reduce such habitat by 156 acres. It is possible that dwelling development in the VLD areas could entirely avoid BCFS-occupied areas, but we conservatively estimate an impact that is proportional to the maximum extent of the habitat modification, which is 10% of 6 BCFS, or the loss of 1 individual. The pathways for this effect are the same as we described for construction activity in the Development areas in section 6.3.1.

6.4 Cumulative Effects on Big Cypress Fox Squirrel

For purposes of consultation under ESA §7, cumulative effects are those caused by future state, tribal, local, or private actions that are reasonably certain to occur in the Action Area. Future Federal actions that are unrelated to the proposed action are not considered, because they require separate consultation under §7 of the ESA.

We identified in section 3 of this BO/CO a projected increase in traffic on public roads as the sole source of effects that are consistent with the definition of cumulative effects for this Action. Roadkill is a documented cause of BCFS mortality in suburban areas (Munim 2008). We expect an increase in traffic on Action Area roads to increase roadkill rates for BCFS where roads cross or adjoin occupied areas; however, we have no data upon which to develop a reasonable relationship between traffic volume and BCFS mortality.

6.5 Conclusion for Big Cypress Fox Squirrel

In this section, we summarize and interpret the findings of the previous sections for the BCFS (status, baseline, effects, and cumulative effects) relative to the species-specific purpose of a BO under §7(a)(2) of the ESA, which is to determine whether the proposed action is likely to jeopardize the continued existence of a species.

<u>Status</u>

The BCFS occurs in the southwestern tip of peninsular Florida, where FWC (2011) reports an area of occupancy of 414,396–948,885 acres, and an estimated abundance of 1,000–7,373 squirrels. The status of BCFS in the core of the species' range, Big Cypress National Preserve and the Everglades, is largely unknown, but is considered declining due to extirpation from several historically occupied locations.

Threats to the BCFS include habitat loss, degradation, and fragmentation; mortality from roads, pets, disease, and toxic substances; and reduction of nesting sites (bromeliads and large trees). The species' primary conservation need is the protection and management of open understory woodlands.

Baseline

The Plan Area contains 63,849 acres of land cover classes that may provide BCFS habitat, including forested wetlands, forested uplands, rural open lands, and improved pasture. Based on reports of the BCFS within the Plan Area and adjacent areas, the species' ability for relatively long-distance movements, and a substantial acreage of habitat types associated with the species, we are reasonably certain that BCFS occupy the Plan Area. Lacking abundance data specific to the Action Area, we use the average of the densities reported for BCFS in cypress swamps and wooded ranchlands (40.8 squirrels/10,000 acres) to estimate that the Plan Area supports about 260 BCFS.

The range-wide conservation needs of and threats to the BCFS are relevant in the Action Area.

Effects

We expect an estimated 9,284 acres of development of BCFS habitat to harm up to 38 BCFS. Due to the relative abundance of BCFS habitat in the Plan Area and low densities, a percentage of animals displaced by construction activity would survive and persist in adjacent areas, but we are unable to estimate this percentage.

The designated Preservation areas of the HCP contain the majority (47,811 acres, or 74.9%) of land cover that we consider as BCFS habitat within the Plan Area. We expect BCFS to persist in the Preservation areas, because the HCP preservation and management activities will, at minimum, maintain current conditions. Special attention to this species in the long-term management of the Preservation areas under conservation easements could increase BCFS densities and the Plan Area population.

Clearing up to 10% of the cover types that we consider as BCFS habitat within the Very Low Density use areas would reduce such habitat by 156 acres. We conservatively estimate an impact that is proportional to the maximum extent of the habitat modification, which is 10% of 6 BCFS, or the loss of 1 individual.

Cumulative Effects

We expect an increase in traffic on Action Area roads to increase roadkill rates for BCFS where roads cross or adjoin occupied areas; however, we have no data upon which to develop a reasonable relationship between traffic volume and BCFS mortality.

Opinion

BCFS are likely to occur in the Plan Area at a low density and with a patchy distribution. Conservatively applying the average of reported densities (40.8/10,000 acres) to habitats of the Plan Area associated with the BCFS indicates that the development activities would harm up to 39 squirrels, with an undeterminable percentage of displaced individuals reestablishing territories in undeveloped areas. Precluding further development in the Preservation areas, and limiting development in the Very Low Density (VLD) areas, would maintain habitat for the remaining 260 – 39 = 221 BCFS that the Plan Area may support.

The loss of up to 39 BCFS would represent a 0.5–3.9% reduction to the range-wide population size of 1,000–7,373. We consider this range a worst-case scenario due to our conservative attribution of an average BCFS density to a portion of the range that is not likely to support a disproportionate share of the range-wide population. Population increases in the Preservation areas, and possibly the VLD use areas, could wholly or partially offset this loss. Such increases would depend on the success of habitat improvements in these areas, which we anticipate are likely, but not guaranteed. An increasing rate of BCFS mortality on Action Area roads is a logical outcome of increasing traffic volume, due to both regional population growth and the new developments of the proposed Action, but present mortality rates are unknown and future rates are unpredictable.

Habitat types that may support BCFS in the Plan Area are relatively abundant and could support a much higher BCFS density with management. The species has demonstrated an ability to colonize non-traditional habitats, including pastures and open rural land, which occur throughout the Plan Area. Both agricultural lands and native habitats will receive protection from further development in the Preservation areas and undeveloped portions of the VLD use areas as other portions of the Plan Area are developed. We believe the following factors support a view that the likely net impact of the Action on the species is substantially less than the worst-case scenario of a 0.5–3.9% population reduction:

- our application of an average BCFS density to Plan Area habitats likely overestimates BCFS numbers;
- increases in habitat quality in the Preservation areas through management under conservation easements are likely; and
- the survival of animals displaced from construction areas is undeterminable, but possibly substantial, due to the abundance of potential habitat and low densities.

Therefore, we believe the net impact of the Action on the BCFS is within the species' ability to sustain.

After reviewing the current status of the species, the environmental baseline for the Action Area, the effects of the Action and the cumulative effects, it is the Service's conference opinion that the Action is not likely to jeopardize the continued existence of the BCFS.

7 Florida Sandhill Crane

This section provides the Service's conference opinion of the Action for the Florida sandhill crane.

7.1 Status of Florida Sandhill Crane

This section summarizes best available data about the biology and current condition of the Florida sandhill crane (*Antigone canadensis pratensis*) throughout its range that are relevant to formulating an opinion about the Action. At this time, the Florida sandhill crane is not protected under the ESA. The Service has not reviewed the species' status relative to the ESA definitions of "endangered" and "threatened." The State of Florida protects the Florida sandhill crane as a threatened species under Florida's Endangered and Threatened Species Rule. For purposes of this Conference Opinion, we summarize the *Species Action Plan for the Florida Sandhill Crane* (FWC 2013), the *Species Conservation Measures and Permitting Guidelines for the Florida Sandhill Crane* (FWC 2016), and other available data to describe the species' status.

7.1.1 Species Description

Sandhill cranes are long-legged, long-necked, heavy-bodied, gray birds with a patch of bald, red skin on top of their heads. Adults average 4 feet in height with a wingspan of 6.5 feet. They fly with their necks outstretched and their distinctive, rattling calls can be heard from far away. Males and females appear identical except the male is slightly larger. Two subspecies of sandhill crane are found in Florida. The Florida sandhill crane (*Antigone canadensis pratensis*) is non-migratory and the greater sandhill crane (*A. c. tabida*) winters in Florida, arriving in October and leaving for breeding grounds in the Great Lakes region in March. Although the two subspecies are indistinguishable, those observed in the peninsula from April to September are most likely the resident Florida subspecies. The two subspecies are not known to interbreed.

7.1.2 Life History

Florida sandhill cranes mate for life and are long-lived, averaging 20 years. Although some start breeding at 3 years old, they are rarely successful until age 5. Florida sandhill cranes nest primarily from February through April, but may begin as early as December and extend through August. Nests are built of plant stems in shallow marshes where water depths average 5 to 13 inches. Although they lay eggs in only one nest, pairs may build accessory nests or platforms. Nesting success is a function of water levels during the nesting season and predation. Pairs can re-nest after a nest failure.

Clutch size can range from one to three eggs, but is usually two. The average incubation period is 30 days and the average brood size is 1.32 chicks. Both members of the pair incubate the eggs and raise the young. The chicks can fly within 65 to 70 days. Flightless young may forage up to 1,500 feet away from the nest site within weeks of hatching. Young sandhill cranes stay with their parents about 10 months before becoming independent and gaining the featherless red crowns. Male and female Florida sandhill cranes disperse a mean distance of 2.4–7.2 miles from their natal territory, respectively. The maximum observed female dispersal distance was 29.8 miles.

Sandhill cranes are omnivorous, feeding on seeds, grain, berries, insects, earthworms, mice, small birds, snakes, lizards, frogs, and crayfish. Florida sandhill cranes forage in a variety of open habitats, including shallow herbaceous wetlands, improved pastures, prairies, open pine forests, croplands, golf courses, airports, sod farms, and road rights-of-way. A pair's average home range is about 1,100 acres, which includes some amount of shallow-water non-forested wetlands for nesting and roosting. Home ranges may overlap, but core nesting areas are defended from other cranes, which varies from 300–635 acres.

7.1.3 Numbers, Reproduction, and Distribution

Florida sandhill cranes occur from the Okeefenokee Swamp, in southern Georgia, to the Everglades. However, most of the population is in peninsular Florida from Alachua County to the northern edge of the Everglades (FWC 2013, Figure 2). The Florida sandhill crane population was estimated at 4,000–6,000 individuals in 1992, and just under 4,600 individuals in 2003 (FWC 2011). Based on inferences from habitat analyses, the population declined by 35.7% from 1974 to 2003 (an average of 1.23% per year). If that trend has continued at the same rate, the population has declined another 20% to around 3,680 in 2019.

7.1.4 Conservation Needs and Threats

Sandhill cranes rely on shallow marshes for roosting and nesting and use open upland and wetland habitats for foraging. Major threats to Florida sandhill cranes are habitat loss and degradation. Most of the remaining habitat is on private lands (*e.g*., urban areas, improved pastures), which are not a priority for conservation. Cranes abandon areas that lack a management regime or natural conditions that maintain low-stature vegetation (*e.g.,* prescribed fire, cattle grazing). Dense vegetation may harbor predators, such as bobcats (*Lynx rufus*). Cranes displaced from habitats that become unsuitable are exposed to an increased risk of mortality from predators and collisions with vehicles, utility lines, and fences. Human presence can increase abundance of predators such as raccoons (*Procyon lotor*) and domestic dogs (*Canis lupus familiaris*). Non-native predators such as coyotes (*Canis latrans*), red fox (*Vulpes vulpes*), feral hogs (*Sus scrofa),* and fire ants (*Solenopsis invicta*) are also a threat. Exposure of cranes and their prey to pesticides and other toxic substances that are commonly used in urban, rural, and agricultural areas is a growing concern (FWC 2013).

Changes in water quantity or timing due to drought, storms, ground water withdrawal, ditching, draining, or flooding can cause nest failures. Low water levels can make nests and young more vulnerable to predators and rapid rises in water levels can flood nests. The effects of climate change on rainfall amounts and timing may exacerbate water-related nest failures. FWC (2016) reports that human activity within 250 feet of nests can cause adults to flush and leave eggs exposed to extreme temperatures, predation, and may cause nest abandonment. More severe and sustained disturbance within 400 feet of nests, such as construction activity, can interrupt nesting behavior and cause nest abandonment. Land conversion within 1,500 feet of nests may significantly impair the ability of flightless young to forage.

The primary conservation need for the Florida sandhill crane is to maintain or increase the area of suitable habitat in order to stabilize or increase the population (FWC 2013). Florida sandhill cranes use a variety of land cover types that have an open aspect, as long as a suitable wetland exists nearby for roosting and nesting. Practices that maintain the open aspect include prescribed fire and cattle grazing.

7.2 Environmental Baseline for Florida Sandhill Crane

This section describes the current condition of the Florida sandhill crane in the Action Area without the consequences to the listed species caused by the proposed Action.

7.2.1 Action Area Numbers, Reproduction, and Distribution

The Plan Area contains 77,760 acres of land cover classes that may provide Florida sandhill crane habitat, including 28,773 acres of non-forested wetland types (marshes, prairies and bogs, isolated freshwater march, and freshwater non-forested wetlands), improved pasture, rural open land, and cropland/pasture (Table 2-1). The Applicants did not conduct Florida sandhill crane surveys of the Plan Area during the development of the HCP. The Biological Assessment for the Rural Lands West Project, which is within the HCP Development area, documented several Florida sandhill cranes on site during May and June of 2007 (Passarella & Associates, Inc. 2017). eBird (2019) reports substantial numbers of adult and juvenile sandhill cranes during the months of April through September within and near the Plan Area, which is when migratory sandhill cranes have left to breed in the Great Lakes region. Therefore, we are reasonably certain that a breeding population of Florida sandhill cranes occupies the Plan Area.

To estimate the size of the breeding population (not including juveniles), we use the mid-point in the range of core nesting area size that breeding pairs defend (300–635 acres, or 467.5 acres). Dividing the extent of non-forested wetland types in the Plan Area (28,773 acres) by 467.5 acres yields habitat for about 62 breeding pairs, or 124 adults with a 1:1 sex ratio. Using the average clutch size of 2 eggs and the average brood size of 1.32 chicks, a stable population of this size would have 124 eggs and 81 chicks during the breeding season each year. At any time, the population would also include birds that are not yet reproductively active (less than 3 to5 years old).

7.2.2 Action Area Conservation Needs and Threats

Threats to the Florida sandhill crane in the Action Area are the same as the range-wide threats, which include:

- loss of non-forested wetland habitats;
- water level extremes during the nesting season;
- predation by native and exotic species;
- disturbance of nesting activities by construction activities and humans;
- collisions with vehicles, utility lines, and fences; and
- exposure to pesticides and other toxic substances.

The primary conservation need for the Florida sandhill crane in the Action Area is to maintain or increase the area of suitable habitat in order to stabilize or increase the population.

7.3 Effects of the Action on Florida Sandhill Crane

This section describes all reasonably certain consequences to the Florida sandhill crane that we predict the proposed Action would cause, including the consequences of other activities not included in the proposed Action that would not occur but for the proposed Action. Such effects may occur later in time and may occur outside the immediate area involved in the Action.

7.3.1 Development and Mining, Base Zoning, and Lands Eligible for Inclusion

The Florida sandhill crane uses several land cover classes represented in the Plan Area and relies on non-forested wetlands for nesting and roosting. These characteristics are consistent with our criteria for applying the Proportional method described in section 2.1.4 to estimate the spatial extent of development impacts. By this method, we estimate that development and mining activities within the development envelope of the Plan Area would result in the loss of 20,594 acres of suitable sandhill crane habitat (the sum of acreages in Table 2-3 column "G" for those cover classes associated with the sandhill crane). The conversion to development and mining uses would involve mostly agricultural and rural open lands that provide foraging habitat (17,669 acres, or 85.8%), but also 2,925 acres of non-forested wetlands that provide roosting habitat year round and nesting habitat in the breeding season.

As a programmatic proposal, the HCP does not specify the timing of project-level construction activities. Florida sandhill cranes are not migratory and are present in the Plan Area year-round. Human activity and noise during the nesting season (February through April) within 400 feet of nests may harm eggs and chicks by causing adults to leave the nest for the duration of the disturbance (FWC 2016). Habitat modifications within 1,500 feet of nest sites (equivalent to a 162-acre circle) may impair feeding essential feeding behavior of flightless chicks (FWC 2016). We expect that construction activities (drainage, clearing, and grading operations) during the nesting season (February–April) within 1,500 feet of nest sites would harm eggs and flightless chicks and displace adults from their core nesting areas. Construction outside the nesting season would avoid harming eggs and chicks, but eliminate nesting habitat in subsequent years. Based on a core nesting area size of 467.5 acres (see section 7.2.1), and complete utilization of the available non-forested wetlands as nesting habitat, development on 2,925 acres of non-forested wetlands would directly or indirectly affect up to about 6 nesting pairs of Florida sandhill cranes. Regardless of the timing of construction, development in shallow-water non-forest wetlands would eliminate roosting habitat.

Development activity in uplands is unlikely to kill or injure sandhill cranes, because they generally avoid human activity, but a substantial loss of foraging habitat within a bird's home range (average 1,100 acres) would cause the individual to forage elsewhere. Adult home ranges overlap, and multiple individuals may forage in the same areas. Following the development, cropland, pasture, and rural open land would remain relatively abundant in the potential development areas (9,633 acres; the total of these three classes from column "H" of Table 2-3) and in the other land use designations of the HCP. Native wetlands habitats for nesting, roosting, and foraging are much more likely to limit local sandhill crane numbers and reproduction, and of these, the nesting habitat requirements are the most specific, because pairs defend a core nesting area. We estimate that the development areas support nesting for up to 6 breeding pairs. Therefore, we believe that habitat loss associated with the development would reduce crane numbers by up to 6 breeding pairs.

Following construction, human occupancy of the developed areas that are located near wetlands that support roosting/nesting cranes could cause an increase in predation by predators attracted to garbage and an increase in exposure to pesticides and other chemicals used in the developed areas. Additional power lines and fences could increase electrocution and entanglement of Florida sandhill cranes. An increase in traffic would likely increase the incidence of vehicles striking cranes. Although these various hazards would increase the risks to individuals that occupy areas near the developed areas, we lack data with which to estimate the amount or extent of probable harm to sandhill cranes. We do not believe that these risks would substantially increase the amount or extent of harm caused by habitat loss.

7.3.2 Preservation Activities

The designated Preservation areas of the HCP contain 44,606 acres of land cover that we consider as Florida sandhill crane habitat (Table 2-1), including 23,693 acres of non-forested wetlands. Based on a core nesting area size of 467.5 acres (see section 7.2.1), and complete utilization of the available non-forested wetlands as nesting habitat, we estimate that these wetlands, and nearby pastures, croplands, and rural open lands, would support up to 51 breeding pairs. Activities in these areas would include prescribed burning, mechanical control of groundcover, mechanical and chemical control of exotic vegetation, and other activities that maintain or improve land quality and existing agricultural uses.

Many of these activities maintain habitat conditions for Florida sandhill cranes. In particular, prescribed burning can control woody encroachment into both uplands and wetlands. Grazing and mowing can maintain open areas for crane foraging. Because nesting occurs in wetlands with shallow water (5 to13 inches deep), direct impacts to eggs and chicks caused by fire or the use of heavy equipment to manage vegetation are unlikely. Outside the breeding season or more than 400 feet from an active nest, FWC (2016) reports that the following activities are unlikely to harm or disturb cranes:

- managing vegetation along utility and highway rights-of-way;
- the routine use of roads, homes, and other infrastructure; and
- routine agricultural operations.

The Applicants propose the following general measures in the Preservation and Very Low Density use areas for sandhill cranes (HCP chapter 7.5.1.1):

- Preserve and maintain sandhill crane habitat in accordance with the terms of the FWC state permit for the HCP Area.
- Mitigate permanent losses of Florida sandhill crane habitat associated with the Covered Activities through preservation, and possibly restoration, enhancement and/or creation of an equal acreage of in-kind Florida sandhill crane habitat.

- Where practicable, in-kind mitigation for wetland impacts will enhance and/or restore suitable short-hydroperiod nesting habitats (shallow open marshes, wet prairies) for the Florida sandhill crane that function across a range of hydrologic conditions.

We do not expect the management of HCP Preservation areas to reduce the numbers, reproduction, or distribution of the Florida sandhill crane to in the Preservation areas, because these activities would, at minimum, maintain current conditions. Special attention to this species in the long-term management of the Preservation areas under conservation easements could increase crane densities and the Plan Area population. However, lacking more detailed information about the Florida sandhill crane in the Plan Area, and about how habitat management under conservation easements may benefit this species, we are unable to reasonably estimate the extent of potential benefits.

7.3.3 Very Low Density Development

The Very Low Density (VLD) use areas of the HCP contain 966 acres of land cover that we consider as Florida sandhill crane habitat (Table 2-1), including 223 acres of freshwater non-forested wetlands. With a core nesting area size of 300–635 acres (see section 7.2.1), the extent of wetlands within the VLD use areas is unlikely to support a breeding pair of sandhill cranes, but may support roosting and foraging for non-breeding cranes and for mature cranes outside the breeding season. Pastures, cropland/pasture, and rural open lands of the VLD areas (743 acres) may also support crane foraging.

Land uses in the VLD areas are similar to the Preservation areas, but may also include isolated residences, lodges, and hunting/fishing camps, at a density of no more than one dwelling unit per 50 acres. The Applicants would continue current ranching/livestock operations and other management activities as described for the Preservation Areas (*e.g.,* exotic species control, prescribed burning). As in the Preservation areas, we do not expect adverse effects resulting from the continuation of the existing land management regimes.

The HCP does not specify a footprint for the isolated residences, lodges, and hunting/fishing camps, but indicates that their construction could clear up to 10% of the existing native vegetation (see section 2.5). New dwelling development could occur within any of the cover types present besides open water and existing development. Clearing up to 10% of the native cover types that we consider as crane habitat would reduce such habitat by 22 acres (Table 2-7). It is possible that dwelling development in the VLD areas could entirely avoid wetlands, but we conservatively estimate a 22-acre habitat loss. Because we do not expect the VLD area wetlands to support nests, this extent of habitat modification is unlikely to kill or injure cranes.

The general measures listed in the HCP for enhancing crane habitat in the Preservation areas apply to the VLD areas as well (see previous section 7.3.2). However, the potential to increase crane numbers or reproduction is limited due to the small extent of non-forested wetlands in the VLD areas.

7.4 Cumulative Effects on Florida Sandhill Crane

For purposes of consultation under ESA §7, cumulative effects are those caused by future state, tribal, local, or private actions that are reasonably certain to occur in the Action Area. Future Federal actions that are unrelated to the proposed action are not considered, because they require separate consultation under §7 of the ESA.

We identified in section 3 of this BO/CO a projected increase in traffic on public roads as the sole source of effects that are consistent with the definition of cumulative effects for this Action. Roadkill is a known cause of Florida sandhill crane mortality. We expect an increase in traffic on Action Area roads to increase roadkill rates for cranes where roads cross or adjoin occupied areas; however, we have no data upon which to develop a reasonable relationship between traffic volume and sandhill crane mortality.

7.5 Conclusion for Florida Sandhill Crane

In this section, we summarize and interpret the findings of the previous sections for the Florida sandhill crane (status, baseline, effects, and cumulative effects) relative to the species-specific purpose of a BO under §7(a)(2) of the ESA, which is to determine whether the proposed action is likely to jeopardize the continued existence of a species.

Status

The Florida sandhill crane population is declining. The most recent population estimate (2003), inferred from habitat availability, was just under 4,600 individuals. Most of the population occurs in peninsular Florida, from Alachua County to the northern edge of the Everglades.

The primary conservation need for the Florida sandhill crane is to maintain or increase the area of suitable habitat in order to stabilize or increase the population. Florida sandhill cranes use a variety of land cover types that have an open aspect, as long as a suitable wetland exists nearby for roosting and nesting. Practices that maintain the open aspect include prescribed fire and cattle grazing.

Baseline

Based on various incidental records, we are reasonably certain that a breeding population of Florida sandhill cranes occupies the Plan Area. The Plan Area contains 77,760 acres of land cover classes that may provide Florida sandhill crane habitat, including 28,773 acres of non-forested wetland types that could support nesting, plus improved pasture, rural open land, and cropland/pasture that could support foraging. Using the average size of the core nesting area that cranes defend and the extent of non-forested wetlands, we estimate that the Plan Area may support up to 62 breeding pairs.

The primary conservation need in the Plan Area is the same as the range-wide need: maintain or increase the area of suitable habitat in order to stabilize or increase the population.

Effects

We estimate that development and mining activities within the development envelope of the Plan Area would result in the loss of 20,594 acres of suitable sandhill crane habitat. The conversion to development and mining uses would involve mostly agricultural and rural open lands that provide foraging habitat (17,669 acres, or 85.8%), but also 2,925 acres of non-forested wetlands that provide roosting habitat year round and nesting habitat in the breeding season. We estimate that these wetlands support nesting for up to 6 breeding pairs. Therefore, we believe that habitat loss associated with the HCP development would reduce crane numbers by up to 6 breeding pairs.

The designated Preservation areas may support up to 51 breeding pairs of cranes. We do not expect the management of Preservation areas to reduce the numbers, reproduction, or distribution of the Florida sandhill crane to in the Preservation areas, because these activities will, at minimum, maintain current conditions. Special attention to this species in the long-term management of the Preservation areas under conservation easements could increase crane densities and the Plan Area population.

Clearing up to 10% of the native cover types that we consider as crane habitat in the Very Low Density (VLD) use areas would reduce crane habitat by 22 acres. Because we do not expect the VLD area wetlands to support nests, this extent of habitat modification is unlikely to kill or injure cranes.

Cumulative Effects

We expect an increase in traffic on Action Area roads to increase roadkill rates for sandhill cranes where roads cross or adjoin occupied areas; however, we have no data upon which to develop a reasonable relationship between traffic volume and crane mortality.

Opinion

The loss of about 3,000 acres of non-forested wetlands to development in the Plan Area would add an increment of habitat loss in the range of the Florida sandhill crane, whose numbers have been declining due primarily to habitat loss since the 1970's. Following full build-out under the HCP, we estimate habitat losses in the Plan Area would cause a population reduction of up to 6 breeding pairs. Extrapolating the rate of decline from 1974–2003, the estimated 2003 population of just under 4,600 mature cranes has possibly declined to about 3,680 in 2019. The loss of 6 breeding pairs over the course of development in the Plan Area relative to either estimate would represent a 0.3% reduction to the range-wide population.

Precluding new development and mining activity in the dedicated Preservation areas would protect a substantial amount of sandhill crane habitat, which we estimate supports the majority (51 breeding pairs, or 82%) of the Plan Area population. As these areas are brought under conservation easements, habitat enhancements that may increase crane numbers are likely, but the amount or extent is not predictable at this time. Where practicable, the Applicants propose to implement project-level mitigation for wetlands impacts that is required for Clean Water Act permits in a manner that enhances or restores marshes and wet prairies for crane nesting. Again, such enhancements appear likely, but the amount or extent is not predictable at this time, and such permits are future federal actions that we do not evaluate in this BO/CO. Given the relatively small impact of the Development activities to crane populations (0.3%) and the likelihood of benefits in the Preservation areas, we believe the net impact of the Action on the Florida sandhill crane is within the species' ability to sustain.

After reviewing the current status of the species, the environmental baseline for the Action Area, the effects of the Action and the cumulative effects, it is the Service's conference opinion that the Action is not likely to jeopardize the continued existence of the Florida sandhill crane.

8 Florida scrub-jay

This section provides the Service's biological opinion of the Action for the Florida scrub-jay.

8.1 Status of Florida Scrub-jay

This section summarizes best available data about the biology and current condition of the Florida scrub-jay (*Aphelocoma coerulescens*) (scrub-jay) throughout its range that are relevant to formulating an opinion about the Action. The Service published its decision to list the scrub-jay as threatened on June 3, 1987 (52 FR 20715-20719).

8.1.1 Species Description

The scrub-jay is about 10 to 12 in (25 to 30 cm) long and weighs about 3 ounces (85 grams). They are similar in size and shape to blue jays (*Cyanocitta cristata*), but differ significantly in coloration (Woolfenden and Fitzpatrick 1996a). Unlike the blue jay, the scrub-jay lacks a crest. It also lacks the conspicuous white-tipped wing and tail feathers, black barring, and bridle of the blue jay. The scrub-jay's head, nape, wings, and tail are blue, and its body is pale gray on its back and belly. Its throat and upper breast are lightly striped and bordered by a pale blue-gray "bib" (Woolfenden and Fitzpatrick 1996a). Scrub-jay sexes are not distinguishable by plumage (Woolfenden and Fitzpatrick 1984), and males, on the average, are only slightly larger than females (Woolfenden 1978). The sexes may be identified by a distinct "hiccup" call made only by females (Woolfenden and Fitzpatrick 1984; Woolfenden and Fitzpatrick 1986). Scrub-jays less than about 5 months of age are easily distinguishable from adults; their plumage is smoky gray on the head and back, and they lack the blue crown and nape of adults. During late summer and early fall, when the first basic molt is nearly done, fledgling scrub-jays are indistinguishable from adults in the field (Woolfenden and Fitzpatrick 1984).

8.1.2 Life History

The scrub-jay is endemic to peninsular Florida's ancient dune ecosystems or scrubs, which occur on well-drained to excessively well-drained sandy soils (Laessle 1958; Laessle 1968; Myers 1990). This relict oak-dominated scrub, or xeric oak scrub, is essential habitat to the scrub-jay, and is adapted to nutrient-poor soils, periodic drought, and frequent fires (Abrahamson 1984). In some cases, scrub-jay habitat occurs as patches of oak scrub within a matrix of little-used habitat of saw palmetto and herbaceous swale marshes (Breininger et al. 1991, Breininger et al. 1995). This matrix of native habitats supply prey for scrub-jays.

Scrub-jays are non-migratory and permanently territorial, occupying multipurpose territories year-round (Woolfenden and Fitzpatrick 1978; Woolfenden and Fitzpatrick 1984; Fitzpatrick et al. 1991). Once scrub-jays pair and become breeders, generally within two territories of their natal area, they stay on their breeding territory until death. In suitable habitat, fewer than 5% of scrub-jays disperse more than 5 miles (8 km) (Fitzpatrick et al. 1991). Stith et al. (1996) believe that a dispersal distance of 5 miles (8 km) is close to the biological maximum for scrub-jays. Scrub-jays live in families ranging from two birds (a single-mated pair) to extended families of eight adults (Woolfenden and Fitzpatrick 1984) and one to four juveniles.

Fledgling scrub-jays stay with the breeding pair in their natal (birth) territory as “helpers,” forming a closely-knit, cooperative family group. Juveniles may stay in their natal territory for up to 6 years before dispersing to become breeders (Woolfenden and Fitzpatrick 1984; Woolfenden and Fitzpatrick 1986). Territory size average 22–25 acres (9–10 ha) (Woolfenden and Fitzpatrick 1990; Fitzpatrick et al. 1991), with a minimum size of about 12 acres (5 ha) (Woolfenden and Fitzpatrick 1984; Fitzpatrick et al. 1991). Nesting normally occurs from March 1 through June 30 (Woolfenden and Fitzpatrick 1984), and clutch size ranges from one to five eggs, but is typically three or four eggs (Woolfenden and Fitzpatrick 1990). Eggs are incubated for 17–19 days (Woolfenden 1974), and fledging occurs 15–21 days after hatching (Woolfenden 1978). Only the breeding female incubates and broods eggs and nestlings (Woolfenden and Fitzpatrick 1984), and the presence of helpers improves fledging success (Woolfenden and Fitzpatrick 1990; Mumme 1992).

The longest observed lifespan of a scrub-jay is 15.5 years at Archbold Biological Station in Highlands County (Woolfenden and Fitzpatrick 1996b). Survival of scrub-jay fledglings to yearling age class averages about 35% in optimal scrub; while annual survival of both adult males and females averages around 80% (Woolfenden and Fitzpatrick 1996b). However, data from Archbold Biological Station indicate that survival and reproductive success of scrub-jays in suboptimal habitat is lower (Woolfenden and Fitzpatrick 1991), which probably explains the extirpation of scrub-jays from unburned, late successional habitats. Similarly, Toland (1991) reported significant differences in mean annual productivity (# young fledged per adult pair) in Indian River County between:

- contiguous optimal scrub (2.2 young);
- fragmented moderately-developed scrub (1.8 young); and
- very fragmented suboptimal scrub (1.2 young).

Scrub-jays forage mostly on or near the ground, often along the edges of natural or man-made openings. They visually search for food by hopping or running along the ground beneath the scrub or by jumping from shrub to shrub. Insects form most of the animal portion of the scrub-jays’ diet (Woolfenden and Fitzpatrick 1984), but small vertebrates are also eaten when encountered. In suburban areas, scrub-jays will accept supplemental foods once the scrub-jays have learned about them (Woolfenden and Fitzpatrick 1984). Acorns are the scrub-jays’ principal plant food (Woolfenden and Fitzpatrick 1984; Fitzpatrick et al. 1991). From August to November each year, scrub-jays may harvest and cache 6,500 to 8,000 oak (*Quercus* sp.) acorns throughout their territory. Acorns are typically buried beneath the surface of bare sand patches in the scrub during fall, and retrieved and consumed year round, though most are consumed in fall and winter (DeGange et al. 1989). Other small nuts, fruits, and seeds also are eaten (Woolfenden and Fitzpatrick 1984).

8.1.3 Numbers, Reproduction, and Distribution

Historically, oak scrub occurred as numerous isolated patches in peninsular Florida, concentrated along both the Atlantic and Gulf coasts and on the central ridges of the peninsula (Davis 1967). Probably until as recently as the 1950s, scrub-jay populations occurred in the oak scrub and scrubby pine flatwoods habitats of 39 of the 40 counties south of, and including Levy, Gilchrist, Alachua, Clay, and Duval Counties. Historically, most of these counties would have contained hundreds or even thousands of breeding pairs (Fitzpatrick et al. 1994). Only the southernmost county, Monroe, lacked scrub-jays (Woolfenden and Fitzpatrick 1996a). Although scrub-jay numbers probably began to decline when European settlement began in Florida (Cox 1987), the decline was first noted in the literature by Byrd (1928).

An extensive statewide survey of scrub-jays in 1992–1993 estimated 3,961 scrub-jay family groups with 10,972 individuals (Fitzpatrick et al. 1994). The survey most likely overestimated the abundance of scrub-jays at Merritt Island National Wildlife Refuge and Cape Canaveral Air Force Station (Boughton and Bowman 2011), but underestimated the abundance of scrub-jays in Ocala National Forest, some areas in southwest Florida, and some areas in southern Brevard and northern Indian River counties (Miller and Stith 2002, Breininger et al. 2003).

The statewide survey indicated that scrub-jays were extirpated from Alachua and Clay counties, although at least one scrub-jay group was later discovered in Clay County (Bowman and Boughton 2011). Ten or fewer scrub-jay groups remained in an additional seven counties (Flagler, Hardee, Hendry, Hernando, Levy, Orange, and Putnam) (Fitzpatrick et al. 1994). Population numbers in 27 of the original 39 counties had 30 or fewer breeding pairs (Fitzpatrick et al. 1994). Fitzpatrick et al. (1994) estimated that scrub-jays had declined between 25–50% in the northern third of the species' range since the surveys by Cox (1987). Woolfenden and Fitzpatrick (1996b) estimated that scrub-jay populations had declined by 90% or more since European settlement. On protected lands, scrub-jays have continued to decline due to inadequate habitat management (Stith 1999; Boughton and Bowman 2011).

Over the last several years, managers of conservation lands have taken steps to reverse the observed decline in scrub-jays on these lands, primarily by more aggressively using fire to improve habitat quality (Hastie and Eckl 1999; Stith 1999; The Nature Conservancy 2001; Turner et al. 2006). If the decline can be reversed, managed lands have the potential to support about twice the number of scrub-jays groups as in 2009 and 2010 (Boughton and Bowman 2011).

8.1.4 Conservation Needs and Threats

Threats to scrub-jays include habitat loss and fragmentation, fire suppression, predation, disease, urban development, and non-native and invasive species. Scrub-jays require a habitat type that occurs only in particular regions within Florida (Woolfenden and Fitzpatrick 1984), which have experienced a substantial alteration for agricultural and residential uses. Habitat loss and fragmentation are the major threats to the species' survival and recovery. Cox (1987) noted local extirpations and major decreases in numbers of scrub-jays and attributed them to the clearing of scrub for housing and citrus groves. Statewide, estimates of scrub habitat loss range from 70 to 90% (Woolfenden and Fitzpatrick 1996a). Fernald (1989), Fitzpatrick *et al.* (1991), and Woolfenden and Fitzpatrick (1996a) noted habitat losses due to agriculture, silviculture, and commercial and residential development were continuing to play a role in the decline in numbers of scrub-jays throughout the state.

Habitat fragmentation increases the probability of inbreeding and genetic isolation, which is likely to increase extinction probability (Fitzpatrick *et al.* 1991; Woolfenden and Fitzpatrick 1991; Stith *et al.* 1996; Thaxton and Hingtgen 1996). Dispersal distances of scrub-jays in fragmented habitat are further than in optimal unfragmented habitats, and demographic success (survival and reproduction rates) is poor (Thaxton and Hingtgen 1996; Breininger 1999). Persistent breeding populations of scrub-jays exist only where there are scrub oaks in sufficient quantity and form to provide an ample winter acorn supply, cover from predators, and nest sites during the spring (Woolfenden and Fitzpatrick 1996b). Scrub-jay dispersal behavior is affected by the intervening land uses. Protected scrub habitats will most effectively sustain scrub-jay populations if they are located within surrounding habitat types that can be used and traversed by scrub-jays. Brushy pastures, scrubby corridors along railway and road rights-of-way, and open burned flatwoods offer links for colonization among scrub-jay populations.

A primary cause for scrub-jay decline is poor demographic success associated with reductions in fire frequency (Woolfenden and Fitzpatrick 1984; Woolfenden and Fitzpatrick 1991; Schaub *et al.* 1992; Stith *et al.* 1996; Breininger *et al.* 1999). Fire suppression may exceed habitat loss as the single most important limiting factor (Woolfenden and Fitzpatrick 1991; Woolfenden and Fitzpatrick 1996a; Fitzpatrick *et al.* 1994). Fitzpatrick *et al.* (1991) reported that overgrown scrub habitats are often occupied by the blue jay; a native predator of scrub-jay nestlings and a competitor for resources. Woolfenden and Fitzpatrick (1996b) and Toland (1999) suggest that hunting efficiency for scrub-jay predators is greater in overgrown scrub habitats.

Predation probably causes most scrub-jay mortality (Woolfenden and Fitzpatrick 1996b). The second most frequent cause may be disease, or predation on disease-weakened scrub-jays (Woolfenden and Fitzpatrick 1996b). Known predators of scrub-jays include several species of snakes, mammals, and birds that eat eggs, nestlings, fledglings, and adults (Woolfenden and Fitzpatrick 1990; Fitzpatrick *et al.* 1991; Schaub *et al.* 1992; Woolfenden and Fitzpatrick 1996a, 1996b; Breininger 1999; Franzreb and Puschock 2004; Miller 2004). Bowman and Averill (1993) noted scrub-jays occupying fragments of scrub found in or near housing developments were more prone to predation by free-roaming cats and to competition from blue jays and mockingbirds. Young scrub-jays are especially vulnerable to ground predators (*e.g.*, snakes and mammals) before they are fully capable of sustained flight.

Scrub-jays host various naturally-occurring parasites that are unlikely to cause population-level impacts. However, the sticktight flea (*Echidnophaga gallinacea*; Woolfenden and Fitzpatrick 1996b), which occurs on some individuals, is believed to lower fitness and potentially cause death (Boughton *et al.* 2006). The host vector for this flea was a domestic dog (*Canis familiaris*), suggesting that introduction of human pets into scrub-jay areas may increase parasite loads and reduce fitness.

Housing and commercial developments within scrub habitats are accompanied by the development of roads. Since scrub-jays often forage along roadsides and other openings in the scrub, they are often killed by passing cars. Research by Mumme *et al.* (2000) along a two-lane paved road indicated that clusters of scrub-jay territories found next to the roadside represented population sinks (breeder mortality exceeds production of breeding-age recruits), which persisted only by immigration from other territories. Since this species may be attracted to roadsides because of their open habitat characteristics, vehicular mortality presents a significant and growing management problem throughout the remaining range of the scrub-jay (Dreschel *et al.* 1990; Mumme *et al.* 2000). The design of scrub preserves should consider proximity to high-speed paved roads (Woolfenden and Fitzpatrick 1996a).

Another potential problem in suburban areas supporting scrub-jays is supplemental feeding by humans (Bowman and Averill 1993; Woolfenden and Fitzpatrick 1996a; Bowman 1998). The presence of additional food may allow scrub-jays to persist in fragmented habitats, but recruitment in these populations is lower than in native habitats. Although human feeding may postpone local extirpations, it cannot substitute for protecting native oak scrub habitat that is necessary for nesting and long-term persistence. Scrub-jays in suburban settings often build nests high in tall shrubbery, which are susceptible to destruction by March winds (Woolfenden and Fitzpatrick 1996b; Bowman 1998).

The invasion of disturbed areas by exotic species, including Brazilian pepper (*Schinus terebinthifolius*), white cypress-pine (*Callitris glaucophylla*), and Australian pine (*Casuarina equisetifolia*), degrades scrub habitat for scrub-jays (Fernald 1989). Other biological stressors associated with human habitation in or near scrub-jay habitats include: domestic dogs and cats, black rats, greenhouse frogs (*Eleutherodactylus planirostris*), giant toads (*Bufo marinus*), Cuban tree frogs (*Osteopilus septentrionalis*), brown anoles (*Anolis sagrei*), and other exotic animal species (Fernald 1989). These exotic species may be predators of scrub-jays, or compete with scrub-jays for space and food. As with roads, the design of scrub preserves should consider proximity to housing developments (Woolfenden and Fitzpatrick 1996a, 1996b).

8.2 Environmental Baseline for Florida Scrub-jay

This section describes the current condition of the Florida scrub-jay in the Action Area without the consequences to the listed species caused by the proposed Action.

8.2.1 Action Area Numbers, Reproduction, and Distribution

The Plan Area contains only 38 acres classified as scrub and scrubby flatwoods, which alone is insufficient to maintain more than a single scrub-jay territory. However, the 1992–1993 statewide scrub-jay survey located 34 families in Lee and Collier counties at the locations shown in Figure 8-1. The largest cluster of families (17 families) occurred in and around Immokalee, which the Plan Area surrounds. A survey of the Immokalee area in March and May of 2007 identified a total of 15 families at the locations shown in Figure 8-2 (Service GIS data). The 2007 scrub-jay detections were in the same general areas as in the 1992–1993 survey, but the 2007 survey results indicate a net loss of 2 families.

Field inspections of areas associated with a FDOT (2014) study of the SR29 corridor in the Immokalee area recorded observations of two scrub-jays at two locations in October 2010, and two scrub-jays at three locations in April 2011. These sightings were in a patch of woodland habitat at the northern edge of developed areas within Immokalee, which the 2007 survey also identified as occupied. Otherwise, the 2007 survey represents the most recent data on the numbers and distribution of the Immokalee cluster. For purposes of this BO, we consider that the Immokalee area continues to support 15 scrub-jay family groups where they were detected in the 2007 survey, of which 4 are located within the Plan Area.

The unincorporated town of Immokalee is not included in the Plan Area; however, we include the roads through Immokalee identified in section 3.1.1 as part of the Action Area, because these roads will experience an increase in traffic volume that would not occur but for the Covered Activities of the HCP. It is likely that one or more individuals from all 15 families of the Immokalee scrub-jay cluster cross these roads during either routine movements within their territories (average size 22–25 acres) or when dispersing to become breeders in another territory (up to about 5 miles). Such crossings would expose these individuals to an increase in vehicular traffic associated with the developments of the HCP and with other sources.

The scrub-jay locations shown in Figure 8-2 are each less than 5 miles from the nearest neighboring location such that dispersal (adult helpers becoming breeders) among the territories of the Immokalee cluster is feasible. The Immokalee cluster is about 7 miles southeast of the nearest isolated scrub-jay family, and 14 miles southeast of the nearest cluster of families, identified in the 1992–1993 survey. With a probable maximum dispersal range of about 5 miles, the scrub-jays of the Immokalee cluster are most likely isolated from all other scrub-jays of the Lee metapopulation defined by Stith (1999).

A family group consists of at least a breeding pair. In optimal habitat, family groups may include up to six additional adult helpers and one to four juveniles (a maximum of 12 birds). The 15 family groups of the Immokalee area could consist of up to 15 × 12 = 180 birds; however, habitat conditions in this area are not optimal. Habitat with scrub characteristics is scarce, fragmented, and degraded. Survival and recruitment rates are lower in suboptimal habitat (see section see section 8.1.2). It is more likely that the Immokalee cluster is comprised of as few as 30 birds (15 breeding pairs), and up to as many as 75 birds (the 15 breeding pairs plus one adult helper and two juveniles per family group).

Surveyors recorded scrub-jays at the 23 locations shown in shown in Figure 8-2, five of which are within the Plan Area. Scrub-jay locations from the March survey that are less than 0.5 mile from scrub-jay locations from the May survey were most likely birds of the same family group territory. If so, the six northern-most locations in figure 8-2 (five within the Plan Area and one nearby just outside the Plan Area) represent points within four scrub-jay territories, which are wholly or partially within the Plan Area. The remaining 17 locations are wholly outside the Plan

Area, but the territories associated with these locations may straddle or abut road segments that we include in the Action Area.

Average scrub-jay territory size is 22–25 acres, with smaller territories in optimal habitat. Territories of the Immokalee cluster are likely larger than average. Using 25-acre circles centered on the five scrub-jay point locations that are within the Plan Area, the northern-most circle lies fully within a designated Development area of the HCP, and contains land cover classified as pasture/cropland and improved pasture. Circles centered on two points that are probably birds from the same family group straddle a junction of designated Development, designated Preserve, and non-Plan Area. These circles contain land cover classified as improved pasture and marshes. The other two circles around points in the Plan Area are wholly within designated Preserve areas.

8.2.2 Action Area Conservation Needs and Threats

The scrub-jays in the Action Area are subject to the same suite of threats described in section 8.1.4 of this document. In particular, the isolated Immokalee cluster is vulnerable to inbreeding effects on reproductive success, and is exposed to the variety of stressors associated with nearby human habitation and degraded habitat conditions. The size of the Immokalee cluster based on the 2007 survey results exceeds a quasi-extinction threshold of 10 breeding pairs (Stith 1999) by only 5 pairs.

Stith (1999) developed a spatially-explicit individual-based model specifically to assess scrub-jay population viability. The model divided the species' range into 21 metapopulations based on apparent physical barriers to scrub-jay dispersal. A metapopulation is defined as "a set of local populations which interact via individuals moving among populations" (Hanski and Gilpin 1991). Results of the model for the Lee metapopulation, comprised of three widely separated clusters of scrub-jay families in parts of Lee and Collier Counties, including the Immokalee cluster, predicted a high risk of extinction or quasi-extinction (falling below 10 breeding pairs) with existing habitat availability. Simulating the addition of the maximum possible amount of scrub habitat (through acquisition and restoration), the model predicted a moderate risk of extinction and a high risk of quasi-extinction. Without additional habitat, the model predicted that the Lee metapopulation would collapse.

Coulon et al. (2008) assigned the scrub-jays near the Caloosahatchee River in Lee County (in the northern part of the Lee and Northern Collier metapopulation) to genetic group K, and did not assign birds of the Immokalee cluster in Collier County to a group. Historic records of scrub-jay observations located between the Caloosahatchee River and the Immokalee clusters suggest that these two groups would likely share the group K genetic profile. Neither the Lee and North Collier metapopulation (genetic group K) or the Immokalee cluster in Collier County are in or near areas that are the focus of current recovery efforts (USFWS 2019). The substantial restoration of scrub habitat that would be necessary to increase numbers of the Immokalee cluster and prevent its eventual extirpation appears unlikely.

8.2.3 Tables and Figures

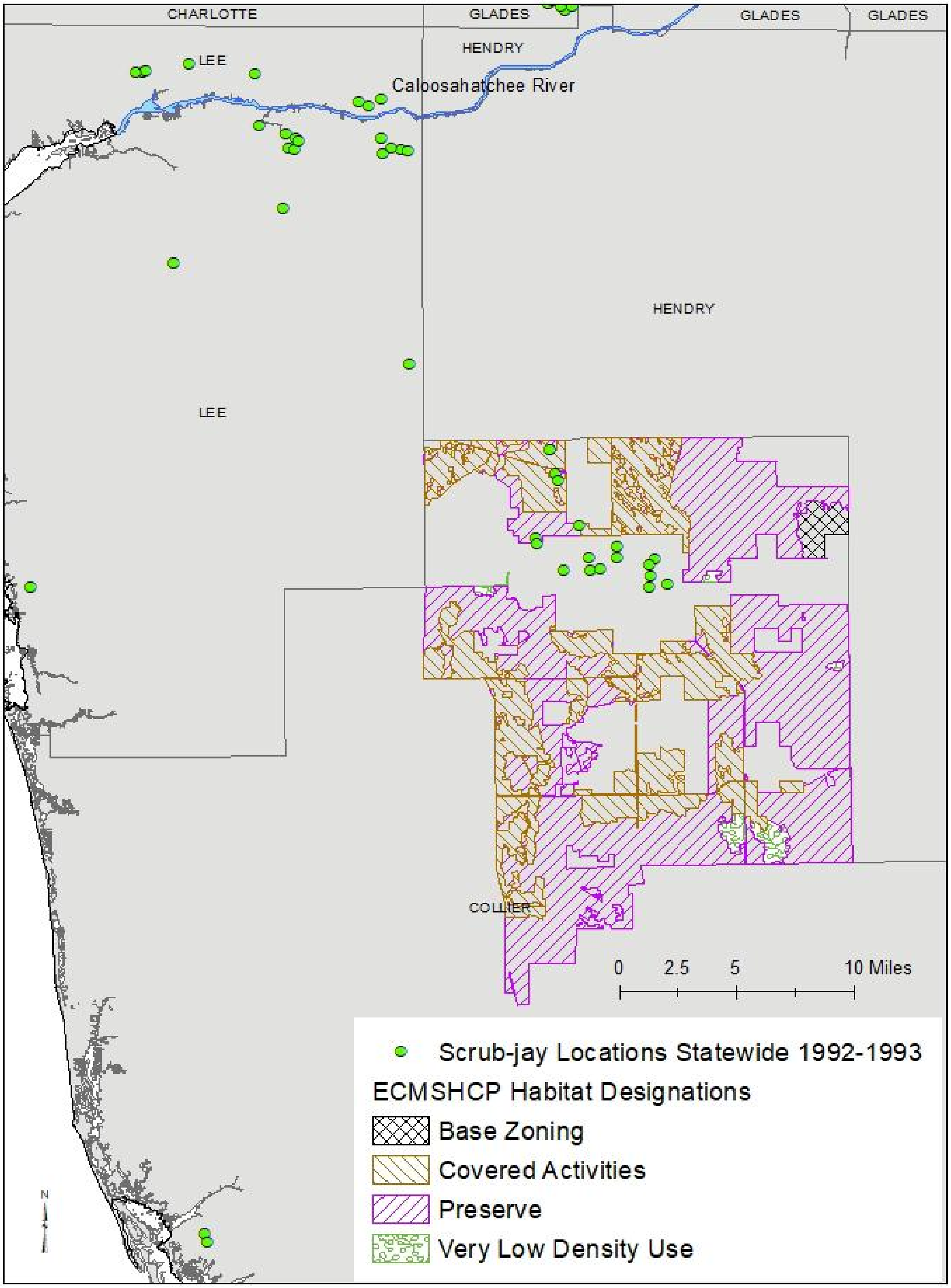


Figure 8-1. Scrub jay locations within and near the Plan Area from the 1992–1993 statewide survey (data source: Fitzpatrick et al. 1994).

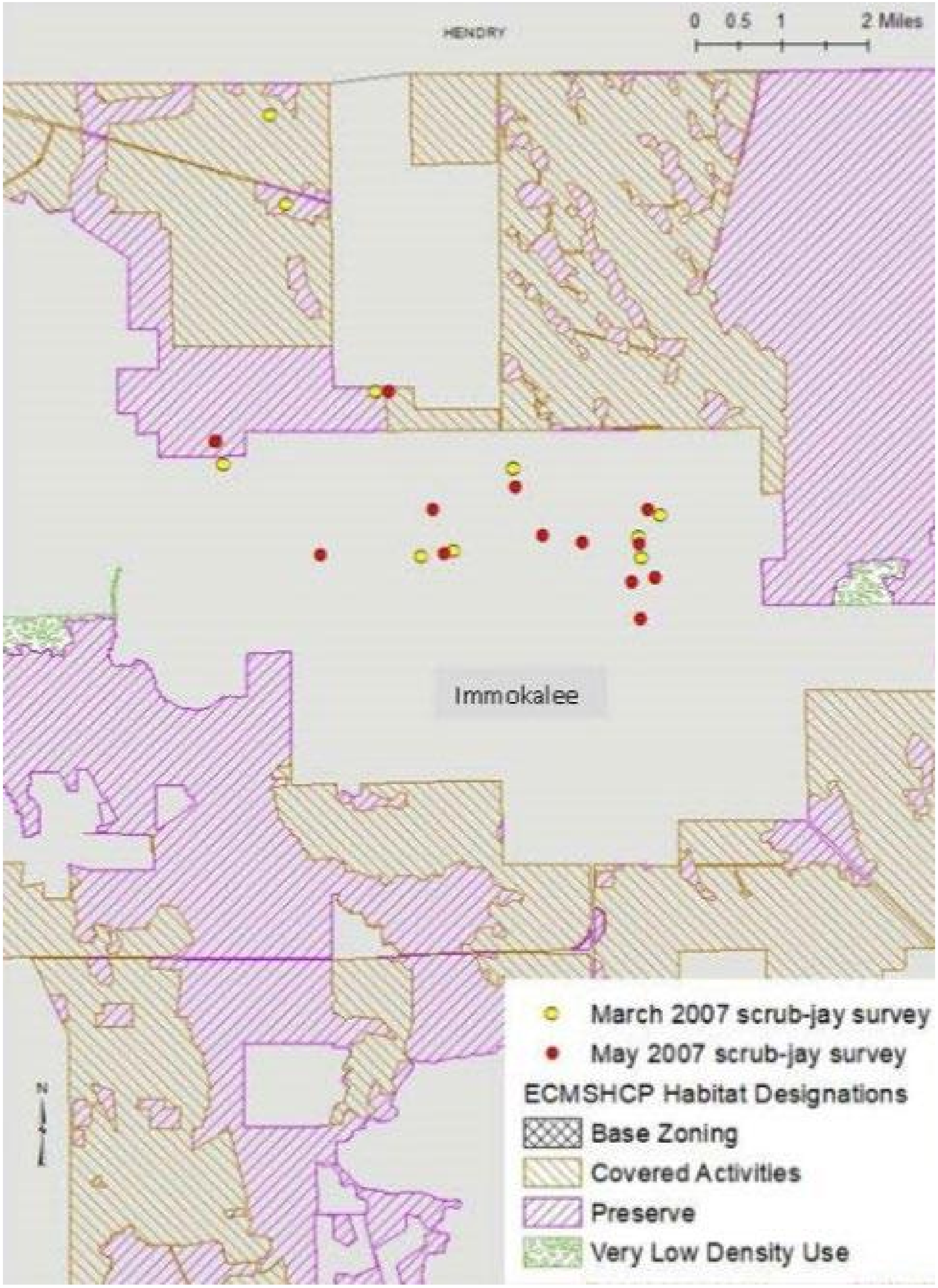


Figure 8-2. Scrub jay locations from a survey of the Immokalee area in March and May of 2007 (data source: Service GIS data).

8.3 Effects of the Action on Florida Scrub-jay

This section describes all reasonably certain consequences to the Florida scrub-jay that we predict the proposed Action would cause, including the consequences of other activities not included in the proposed Action that would not occur but for the proposed Action. Such effects may occur later in time and may occur outside the immediate area involved in the Action.

8.3.1 Development and Mining, Base Zoning, and Eligible Lands

The scarcity of scrub and scrubby flatwoods in the Plan Area (38 acres) suggests that scrub-jays are highly unlikely to occur in areas besides the locations identified in section 8.2.1, where we expect that 30–75 birds of the Immokalee cluster persist in fragmented patches of sub-optimal habitat. Therefore, our effects analyses are limited to these previously documented locations. Based on data from 2007 (see section 8.2.1), we believe the designated Development areas wholly contain one scrub-jay territory, and a portion of a second territory. We have no data that indicates scrub-jays occur within the Base Zoning and Eligible Lands designations.

In section 7.2.1.4 of the HCP, the Applicants propose to:

(a) conduct scrub-jay surveys as particular development projects prepare for permitting in areas where prior occurrence data and/or the presence of potential habitats (scrub oaks, scrubby flatwoods, *etc.*) are observed;

(b) observe a 50-meter (164-foot) buffer around any occupied "habitat/nest" until any young have fledged;

(c) translocate "any isolated individual Florida scrub-jays or family groups" birds to a viable population, to the extent possible and in coordination with the Service, located within development project areas; and

(d) mitigate unavoidable impacts to occupied scrub-jay habitats by:

   a. enhancing and/or restoring an equal acreage of in-kind Florida scrub-jay habitat within the Immokalee Urban Area; OR

   b. contributing funds commensurate with the impacts to the Florida Scrub-Jay Conservation Fund.

Measures (a)–(c) make it unlikely that construction activities would kill or injure scrub-jays. The translocation of birds could supplement the numbers of another population for recovery purposes, but is not a recovery action the Service would permit under ESA section 10(a)(1)(A). Translocation involves capturing and handling a listed species, which is prohibited without special authorization. To authorize an action that is intended to avoid incidental take that would otherwise occur, a section 10(a)(1)(B) ITP issued for this HCP would need to provide terms and conditions applicable to the translocation, such as personnel qualifications, capture and handling protocols, and coordination with the Service regarding sites that would receive the birds. If the occupied territories of translocated scrub-jays are developed for residential/commercial or mining uses, these areas would no longer support scrub-jays.

Enhancing and/or restoring an equal acreage of in-kind Florida scrub-jay habitat within the Immokalee area would partially offset the habitat loss, due to the time lag between the loss and achieving a functional habitat gain elsewhere. Service (2009) guidance for using the Florida

Scrub-Jay Conservation Fund or other Service-approved conservation bank specifies the acquisition of 2 acres of scrub-jay habitat for each acre of occupied scrub-jay habitat affected to achieve a full offset of habitat impacts.

We expect that development will displace through translocation one family group from the Plan Area, and affect a second family group with a territory that may straddle the intersection of designated Development, Preservation, and non-HCP lands. The impacts of development on this second family group would depend on site-specific factors (*e.g.,* which property supports nesting, the distribution and abundance of food resources between the properties, *etc.*). However, given the general scarcity of scrub-jay habitat resources in the area, we expect that resources remaining following the loss of those within the developed portion of the territory would no longer support a family group. Therefore, we expect the loss from the Plan Area of up to 4–10 scrub jays (two breeding pairs and possibly one adult helper and two juveniles per family group). Development would permanently preclude scrub-jay use of the developed areas.

The two scrub-jay territories located in Development areas are close enough to some of the other 13 territories of the Immokalee cluster for individuals to interact, but whether they do is unknown. Some degree of interaction between groups within the cluster probably contributed to maintaining until 2007, through dispersal and territory turnover, 15 of the 17 family groups identified in the 1992–1993 statewide scrub-jay survey. The loss of two more family groups and their habitat would:

- accelerate the loss of genetic diversity within the isolated Immokalee cluster;
- reduce the potential for dispersal to provide breeders for vacant territories; and
- increase the cluster's vulnerability to extirpation by catastrophic events/conditions (*e.g.,* hurricane, extended drought, disease).

8.3.2 Preservation Activities

Two of the four scrub-jay family territories that we believe occur within the Plan Area (see section 8.2.1 and Figure 8-2) are wholly within designated Preservation areas. We explained in the previous section (8.3.1) that we expect the loss of scrub-jays from a third territory that is partially within a Preservation area, but likely straddles designated Development lands and non-HCP lands as well. We do not include this latter family group and its territory it in our analyses of the effects of Preservation Activities.

Conservation easements on Preservation lands would preclude future development and mining activities, but would allow existing agricultural land uses to continue. Covered Activities in the Preservation Areas include prescribed burning, mechanical control of groundcover, ditch and canal maintenance, mechanical and chemical control of exotic vegetation, soil tillage, and other activities that maintain or improve land quality and agricultural uses.

Exposure to environmental changes caused by Covered Activities for the Preservation areas may cause a mix of beneficial and adverse scrub-jay responses. Prescribed burning can disrupt normal breeding, feeding, and sheltering behaviors while scrub-jays avoid smoke and heat, and impair such behaviors if an entire territory is burned at one time. However, burning also maintains the open woodland conditions that scrub-jays require. Similarly, use of mechanical equipment for groundcover control or exotic vegetation treatments can disrupt normal breeding, feeding, and sheltering behaviors while scrub-jays avoid the noise and human activity, but also maintain open conditions when fire does not. Soil tillage where scrub-jays have cached acorns, typically along the edges of wooded cover, reduces food availability. Ditch and canal maintenance that involves removing scrub oaks from the tops of canal banks would also remove a scrub-jay habitat resource, but we do not know whether such canals are present in occupied territories of the Preservation areas. Scrub-jays could become sick or die if exposed to chemicals used for agricultural or exotic vegetation control purposes in occupied portions of the Preservation areas, but we cannot determine whether such exposure and adverse responses are reasonably certain to occur.

We do not expect the management of Preservation areas to reduce the numbers, reproduction, or distribution of the scrub-jay in the Preservation areas, because these activities would, at minimum, maintain current conditions. Special attention to this species in the long-term management of Preserves in the Immokalee area could increase scrub-jay numbers and possibly contribute to maintaining the Immokalee cluster. However, lacking more detailed information about how habitat management under conservation easements may benefit this species, we are unable to reasonably estimate the extent of potential benefits.

8.3.3 Very Low Density Development

We have no evidence that suggests scrub-jays may occur in the Very Low Density (VLD) use areas. The VLD areas are not near or located between any known scrub-jay territories; therefore, any changes in these areas would not hinder scrub-jay dispersal between territories. We expect no effects to scrub-jays from Covered Activities in the VLD areas.

8.4 Cumulative Effects on Florida Scrub-jay

For purposes of consultation under ESA §7, cumulative effects are those caused by future state, tribal, local, or private actions that are reasonably certain to occur in the Action Area. Future Federal actions that are unrelated to the proposed action are not considered, because they require separate consultation under §7 of the ESA.

We identified in section 3 of this BO/CO a projected increase in traffic on public roads as the sole source of effects that are consistent with the definition of cumulative effects for this Action. Roadkill is a known cause of Florida scrub-jay mortality. An increase in traffic on Action Area roads could increase roadkill rates for scrub-jays where roads cross or adjoin occupied territories of the Immokalee cluster, both within and outside the Plan Area. However, we have no data upon which to develop a reasonable relationship between traffic volume and scrub-jay mortality.

8.5 Conclusion for Florida Scrub-jay

In this section, we summarize and interpret the findings of the previous sections for the scrub-jay (status, baseline, effects, and cumulative effects) relative to the species-specific purpose of a BO under §7(a)(2) of the ESA, which is to determine whether the proposed action is likely to jeopardize the continued existence of a species.

Status

Since the time of European settlement, scrub-jay numbers have declined up to 90%, depending on the location. A 1992–1993 statewide scrub-jay survey estimated 3,961 extant scrub-jay family groups comprised of 10,972 individuals. Since the survey, scrub-jays continued to decline on protected lands due to inadequate habitat management, which is likely the case on unprotected private lands as well. However, steps to reverse the decline on protected lands are ongoing.

The greatest threats to scrub-jays are habitat loss, fragmentation, and degradation caused by residential and commercial development, conversion of scrub lands to citrus and other agricultural uses, sand mining, displacement of scrub oaks by invasive exotic species such as Brazilian pepper, and fire suppression. Habitat fragmentation that widely separates local populations from others increases the probability of inbreeding and genetic isolation, which increases the probability of local population extirpation. Inter-specific competition for habitat resources, non-native predators, and collisions with vehicles are additional threats to scrub-jays throughout their range.

Baseline

The Plan Area contains only 38 acres classified as scrub and scrubby flatwoods, which alone is insufficient to maintain more than a single scrub-jay territory. The 1992–1993 statewide scrub-jay survey located a cluster of 17 scrub-jay families in and around Immokalee, which the Plan Area surrounds. A survey of the Immokalee area in March and May of 2007 identified a total of 15 families in the same general areas.

For purposes of this BO, we consider that the Immokalee area continues to support 15 scrub-jay family groups where they were detected in the 2007 survey, of which 4 likely territories are located within the Plan Area. Scrub-jays of the Immokalee cluster are probably isolated from all other scrub-jays of the Lee/Collier metapopulation defined by Stith (1999). We estimate that the Immokalee cluster is comprised of as few as 30 birds (15 breeding pairs), and up to as many as 75 birds (the 15 breeding pairs plus one adult helper and two juveniles per family group). Land cover within 25-acre circles centered on the 2007 survey detections located in the Plan Area consists of pasture/cropland, improved pasture, and marshes.

The isolated Immokalee cluster is vulnerable to inbreeding effects on reproductive success, and is exposed to the variety of stressors associated with nearby human habitation and degraded habitat conditions. The size of the Immokalee cluster based on the 2007 survey results exceeds a quasi-extinction threshold of 10 breeding pairs (Stith 1999) by only 5 pairs. Without additional habitat, a 1999 population viability model predicted that the Lee and Norther Collier metapopulation would collapse. The Lee and Norther Collier metapopulation is not in or near areas that are the focus of current scrub-jay recovery efforts (USFWS 2019).

Effects

The Applicants propose to conduct project-level scrub-jay surveys where prior occurrence data and/or the presence of potential habitats are observed, observe a 50-meter buffer around active nests, translocate birds in coordination with the Service, and compensate for unavoidable impacts to habitats by enhancing/restoring habitats in the Immokalee area or contributing to the Florida Scrub-Jay Conservation Fund. We believe the designated Development areas wholly contain one scrub-jay territory, and a portion of a second territory. We expect the loss from the Plan Area of up to 4–10 scrub jays (two breeding pairs and possibly one adult helper and two juveniles per family group). Reducing the Immokalee cluster by up to 2 family groups would:

- accelerate the loss of genetic diversity within the isolated Immokalee cluster;
- reduce the potential for dispersal to provide breeders for vacant territories; and
- the cluster's vulnerability to extirpation by catastrophic events/conditions (*e.g.,* hurricane, extended drought, disease).

We believe the designated Preservation areas wholly contain two scrub-jay territories. We do not expect the management of Preservation areas to reduce the numbers, reproduction, or distribution of these family groups, Preservation activities would, at minimum, maintain current conditions. Special attention to this species in the long-term management of Preserves in the Immokalee area could increase scrub-jay numbers and possibly contribute to maintaining the Immokalee cluster.

Cumulative Effects

An increase in traffic on Action Area roads could increase roadkill rates for scrub-jays of the Immokalee cluster where roads cross or adjoin occupied areas; however, we have no data upon which to develop a reasonable relationship between traffic volume and scrub-jay mortality.

Opinion

The loss of sub-optimal habitat that may still support two scrub-jay family groups (4–10 individuals) in the Plan Area would add an increment of habitat loss in the range of species, whose numbers have been declining due largely to habitat loss for many decades. Translocating these individuals could augment the numbers of more viable populations elsewhere, but the success of such an effort is not guaranteed. Relative to the 1992-1993 range-wide population estimate of about 4,000 breeding pairs, the possible loss of 2 breeding pairs represents a 0.05% reduction. If current numbers are instead about 2,000 breeding pairs, the loss would represent a 0.1% reduction.

Precluding new development and mining activity in the dedicated Preservation areas would protect the habitat that may still support another two scrub-jay family groups. As these areas are brought under conservation easements, habitat enhancements that may increase scrub-jay numbers are possible, but not reasonably certain using data available at this time. Maintaining current conditions in the Preservation areas could maintain the resident scrub-jay groups for some time. However, the long-term persistence of the Immokalee cluster, which may include another 11 family groups outside the Plan Area, appears unlikely without substantial increases in suitable habitat. Such increases are not reasonably foreseeable. Regardless, given the relatively small effect of the Development activities in the range-wide context, and the Applicants' commitment to translocate affected birds and to compensate for unavoidable habitat losses, we believe the net impact of the Action on the Florida scrub-jay is within the species' ability to sustain.

After reviewing the current status of the species, the environmental baseline for the Action Area, the effects of the Action and the cumulative effects, it is the Service's biological opinion that the Action is not likely to jeopardize the continued existence of the scrub-jay.

9 Florida Burrowing Owl

This section provides the Service's conference opinion of the Action for the Florida burrowing owl.

9.1 Status of Florida Burrowing Owl

This section summarizes best available data about the biology and current condition of the Florida burrowing owl (*Athene cunicularia floridana*) throughout its range that are relevant to formulating an opinion about the Action. At this time, the burrowing owl is not protected under the ESA. The Service has not reviewed the species' status relative to the ESA definitions of "endangered" and "threatened." The State of Florida protects the burrowing owl as a threatened species under Florida's Endangered and Threatened Species Rule. For purposes of this Conference Opinion, we summarize the *Species Action Plan for the Florida Burrowing Owl* (FWC 2013), the S*pecies Conservation Measures and Permitting Guidelines for the Florida Burrowing Owl* (FWC 2018), and other available data to describe the species' status.

9.1.1 Species Description

The Florida burrowing owl is a small, long-legged owl with sandy brown plumage. Adults average 9 inches in height with a mean wingspan of 21 inches. The face is accented by bright yellow, sometimes with black mottling, and a white chin. The ear tufts of the typical woodland owls are lacking on the burrowing owls. Unlike most owls, burrowing owls are active during both day and night. During the day, owls stand at the mouth of their burrow or on a nearby post. When disturbed, owls bob in agitation and utter a chattering or clucking call. In flight, burrowing owls typically undulate as if they are flying an invisible obstacle course. Foraging owls can hover midair before pouncing on prey. Burrowing owls mainly eat insects, especially grasshoppers and beetles, but also small lizards, frogs, snakes, birds, and rodents.

9.1.2 Life History

Florida burrowing owls live as single breeding pairs or in loose colonies consisting of two or more families. They typically dig their own burrows, but will use gopher tortoise (*Gopherus polyphemus*) or armadillo (*Dasypus novemcinctus*) burrows and other structures, such as manholes, sewer drains, and concrete pipes. Owl family units will often use a breeding burrow and one or more satellite burrows. Burrows are typically 6 to 9 feet in length, up to 3 feet deep, and lined with grass clippings, feathers, paper, and manure. In urban areas, burrowing owls use burrows for roosting during the winter and for breeding during the nesting season. However, in rural areas, burrowing owls may have limited use of burrows outside of the nesting season.

The typical nesting season is from February to July. Most egg laying is in March, but may occur as early as October and as late as May. The female lays 6 to 8 eggs over a 1-week period. Incubation lasts about 4 weeks, and young start to emerge from the burrow around 2 weeks after hatching. The juveniles start learning to fly at 4 weeks, but cannot fly well until they are 6 weeks old. Juveniles continue to use their parents' burrows for 30 to 60 days after they are able to fly. After breeding, burrowing owls may remain in their breeding area or disperse (maximum documented dispersal of 46 miles) (Mrykalo 2005).

9.1.3 Numbers, Reproduction, and Distribution

The Florida burrowing owl occurs primarily in peninsular Florida, although isolated pairs and small colonies have been found as far west as Eglin Air Force Base and as far south as the Dry Tortugas. Burrowing owls typically inhabit open grassy habitats, with localized and patchy distribution. The dry prairies of central Florida provided habitat historically, but due to increasing development, the species' range has expanded north, south, and to the coasts. Burrowing owls now most commonly occur in pastures, golf courses, airports, school yards, and vacant lots. The highest concentrations of burrowing owls in Florida are in Cape Coral, Marco Island, and along the southeast coast.

The current range-wide abundance of the Florida burrowing owl is unknown. It appears that the use of native habitats has decreased and the use of urban areas has increased. The urban birds are adapted to human activity and occupy some areas at high densities. A 1996 estimate placed statewide owl abundance at 3,000–10,000, and a 2001 review of occurrence data identified 1,757 unique records (FWC 2011). The latter number likely under-represents burrowing owls in rural areas due to low densities and limited access to private property. Recent population data from Marco Island and Cape Coral show that the number of burrowing owls in urban areas is increasing. As of November 2016, Marco Island had over 400 owls (Audubon of the Western Everglades 2016), and a May 2017 census of Cape Coral counted approximately 3,700 owls (Cape Coral Burrowing Owls 2019). These two areas account for at least 4,100 burrowing owls in Florida, which does not include the southeast coast and rural populations.

9.1.4 Conservation Needs and Threats

Burrowing owls require sufficient foraging habitat around their burrows, and loss of foraging habitat can impair essential behaviors. In rural areas, potential foraging habitat includes dry prairie, mowed grass, vegetative berms, rural open areas (with few trees), row crops and field crops (with low vegetation), improved pasture, sod farms, wet prairie, and depression marsh. In urban areas, burrowing owls forage in vacant lots, yards, cemeteries, airports, golf courses, athletic fields, and other open areas. Based upon an average foraging radius of 1,970 feet from the nest burrow for western burrowing owls in rural areas, FWC considers that Florida burrowing owls need a foraging area of 280 acres (FWC 2018).

The major threats to the Florida burrowing owl are loss of native habitat and the resulting reliance on human-altered habitat. In urban areas, preferred nesting habitat and burrows are destroyed by construction activities, domestic animals (*e.g*., dogs), and humans. FWC (2018) found that burrowing owl nests within 33 feet of construction activity had significantly lower productivity. Collisions with automobiles are a frequent cause of owl mortality in urban areas, and human disturbance can cause burrow abandonment. Domestic animals (*e.g*., cats, dogs) and exotic wildlife (*e.g*., large lizards) likely also contribute to owl mortality. Iguanas, for example, have been observed occupying burrowing owl burrows. The proximity of the largest populations of this species to coastal areas carries the increasing threat of impacts from hurricanes, tropical storms, and sea level rise due to global climate change.

For burrowing owls in rural areas, lack of protected habitat is a concern. Urban and agricultural areas (*e.g*., athletic fields, improved pastures) are not a priority for conservation, but many support burrowing owls. Management strategies for owls in such settings are lacking. No data is available about the effects on burrowing owls of contaminants, pesticides, and herbicides commonly used in urban and rural open spaces. Murray (2011) documented instances of owls and other raptors sickened or killed after eating prey that have consumed anticoagulant rodenticides, which are frequently used in both urban and agricultural areas. Conservation needs include increased habitat protection/management, as described in the S*pecies Conservation Measures and Permitting Guidelines for the Florida Burrowing Owl* (FWC 2018).

9.2 Environmental Baseline for Florida Burrowing Owl

This section describes the current condition of the Florida burrowing owl in the Action Area without the consequences to the listed species caused by the proposed Action.

9.2.1 Action Area Numbers, Reproduction, and Distribution

The Plan Area contains up to 48,988 acres of land cover that is suitable habitat for burrowing owls, which includes improved pasture, rural open land, and cropland/pasture (see Table 2-1). Unimproved pasture is included in the cropland/pasture cover type. Cultivated cropland (routinely tilled) is unlikely to support owl burrows, but may support foraging. Native dry prairie upland habitats associated with burrowing owls (*e.g.,*) are not present in the Plan Area.

The Applicants did not conduct burrowing owl surveys of the Plan Area during the development of the HCP. Available data includes five confirmed and one possible location within or very near the Plan Area (FWC 2003). Studies supporting State and Federal permitting in 2004-2005 for the Town of Ave Maria determined that 11 burrowing owls occupied the 4,466 acres of suitable habitat within the town footprint (USFWS 2005). The Plan Area surrounds, but does not include, Ave Maria.

Cape Coral and Marco Island contain large, well-monitored populations of burrowing owls located east of the Plan Area. Given known locations within and near the Plan Area, large dispersal distances, and the presence of suitable habitat, we are reasonably certain that burrowing owls occupy the Plan Area. Using the density of Florida burrowing owls documented in the Ave Maria studies (11 owls ÷ 4,466 acres = 0.00246 owls/acre), we estimate that 48,988 acres of owl habitat in the Plan Area supports up to 121 burrowing owls, which includes the full extent of the cropland/pasture cover type as suitable habitat.

9.2.2 Action Area Conservation Needs and Threats

Threats to the Florida burrowing owl in the Action Area include predation by native and exotic species, destruction of burrows by construction activities, disturbance by domestic animals and humans, collisions with vehicles, and exposure to contaminants, rodenticides, pesticides, and herbicides. Records show at least 3 great-horned owls, 1 barred owl, and over 30 red-shouldered hawks have died of suspected rodenticide poisoning in Collier and Lee counties since 2011 (J. Fitzgerald, von Arx Wildlife Hospital, personal communication). Conservation needs include increased habitat protection/management, as described in the S*pecies Conservation Measures and Permitting Guidelines for the Florida Burrowing Owl* (FWC 2018).

9.3 Effects of the Action on Florida Burrowing Owl

This section describes all reasonably certain consequences to the Florida burrowing owl that we predict the proposed Action would cause, including the consequences of other activities not included in the proposed Action that would not occur but for the proposed Action. Such effects may occur later in time and may occur outside the immediate area involved in the Action.

9.3.1 Development and Mining, Base Zoning, and Eligible Lands

Because burrowing owls likely use the open agricultural cover types of the Plan Area, and it is plausible that development would occur disproportionately in these non-wetland cover types, we used the RMI method described in section 2.1.4 to estimate the extent of development in burrowing owl habitats. The extent of burrowing owl cover types (improved pasture, rural open land, and cropland/pasture) within the designated Development areas, Base Zoning, and Eligible lands is 20,356, 1,781, and 5,195 acres, respectively, or a total of 27,332 acres, which is less than the development cap of 39,973 acres. Therefore, high-density development confined entirely to the Development areas, or implemented with the maximum possible substitution of Base Zoning and/or Eligible lands in the accounting for the cap, could replace all burrowing owl habitat in one or more of these HCP land use designations.

The proposed action would involve clearing, grading, vegetation removal, excavation and piling, transport of aggregate by trucks, and construction of buildings and associated infrastructure. Such substantial alterations of land that supports essential owl feeding, breeding, and sheltering behaviors would disturb, displace, injure, or kill burrowing owls that are present at the time of those actions, depending on timing and other site- and project-specific circumstances.

The Applicants propose to time construction activity to avoid and minimize impacts to Florida burrowing owl nesting. Before construction at a site begins, the Applicants propose to conduct burrowing owl surveys according to FWC survey protocols (FWC 2018). Based on survey results, construction activity would maintain a buffer of at least 33 feet around burrows during the breeding season and 10 feet during the non-breeding season, as recommended by FWC (2018).

Burrowing owls may use their burrows year-round, and construction activities near burrows can disrupt breeding and sheltering activities. Collapsing or blocking burrows during clearing, grading, excavation, or piling can kill or injure adults, juveniles, or eggs within the burrows. Burrowing owls require approximately 280 acres of foraging habitat around their burrows, and habitat modification resulting in a loss of more than 50 percent of foraging habitat impairs essential feeding behavior (FWC 2018). Development and mining activity that overlaps the home range of an owl would eliminate foraging habitat outside the 33-foot buffers around burrows, which is a 99 percent loss from a foraging area of 280 acres.

A substantial loss of foraging habitat around burrows would cause burrowing owls to travel farther to find food. The use of anticoagulant rodenticides around developed areas could reduce the prey available for burrowing owls and sicken or kill any owls that consume poisoned rodents. Increased vehicle traffic during and after construction would likely increase mortality and injury caused by collisions with vehicles. The presence of humans post-construction could increase predation by both native predators attracted to garbage and introduced exotic species, and increase the destruction or disturbance of burrows by domestic animals.

Because 27,332 acres of the suitable burrowing owl habitat in the Plan Area are located in the Development, Mining, Base Zoning, and Eligible Lands areas, we expect that up to 67 owls (27,332 acres × 0.00246 owls/acre) would experience the adverse effects described above. Such effects would coincide with development activity at unspecified times during the 50-year permit period. The pre-development surveys and buffers around burrows should avoid the immediate death and injury caused by burrow destruction. However, we expect that full HCP development would cause all 67 owls to experience a loss of foraging habitat and/or disturbance that would displace them to other areas of suitable habitat available within the species' dispersal capabilities. The low density of owls and the abundance of pastures and rural open lands in the Plan area suggest that a substantial percentage of owls could survive a gradual displacement caused by development activity, but some would not survive the hazards (*e.g.,* vehicle strikes, predators, *etc.*) associated with relocating feeding, breeding, and sheltering activity to an unfamiliar area. Those surviving dispersal would likely experience the injury of reduced reproductive success until established in a new area.

Therefore, we expect take in the form of harm (habitat modification that actually causes subsequent death or injury) of up to 67 owls in the Development, Mining, Base Zoning, and Eligible Lands areas, depending on the distribution of 39,973 acres of high-density development. We have no data or reasonable basis to estimate the percentage of lethal versus injurious responses (*e.g.,* impaired reproduction) to action-caused changes in these areas. Although burrowing owls could use open areas that remain following construction or mining until full build-out occurs, we believe owls are more likely to persist long-term in the open rural areas of the Preservation and Very Low Density Development areas (see the following sections 9.3.2 and 9.3.3).

9.3.2 Preservation Activities

Approximately 20,913 acres of burrowing owl habitat occur within the Preservation areas (4,155 acres rural open lands, 7,599 acres improved pastures, and 9,159 acres cropland/pasture), which the Applicants would place under conservation easements as development occurs elsewhere. These easements would preclude future commercial and residential development and earth mining, but would allow a continuation of the existing agricultural land uses. Activities in the Preservation areas would include prescribed burning, mechanical control of groundcover, ditch and canal maintenance, mechanical and chemical control of exotic vegetation, soil tillage, cattle grazing, pesticide and herbicide applications, and other activities that maintain or improve land quality and agricultural uses.

Although many of these activities maintain habitat for burrowing owls, some can also disrupt normal behaviors, injure, or kill owls that are present at the time. Prescribed burning maintains open habitat conditions that burrowing owls require. Burning may also cause owls to take refuge in their burrows, which temporarily disrupts feeding behavior, and may kill or injure some owls through heat or smoke inhalation. Heavy equipment used for groundcover control, exotic vegetation treatments, or soil tillage may crush owls in their burrows. Grazing cattle at high stocking rates may degrade foraging habitat and collapse burrows. Exposure to chemicals (pesticides, rodenticides, insecticides, fungicides and/or herbicides) associated with agricultural uses could kill or sicken owls. To minimize impacts to burrowing owls, the Applicants propose to follow FWC's recommended conservation measures in rural areas (FWC 2018), which we summarize here:

- Avoid the use of pesticides, rodenticides, insecticides, fungicides and/or herbicides immediately around the burrow entrance. Reduce or avoid the use of these products in burrowing owl foraging habitat to the extent practicable, especially during nesting season. Use these products according to label instructions.
- Maintain low vegetation heights beneficial for burrowing owl foraging through mowing, prescribed grazing, and/or prescribed burning.
- Manage invasive, non-native plant species if they reduce habitat quality for burrowing owls. If invasive, non-native shrubs or trees are encroaching on a burrow, wait until after the breeding season to treat the vegetation, and remove the vegetation only if removal will not result in collapse of the burrow.
- Reduce the amount of foraging habitat converted to more intensive agricultural land uses (*e.g.*, row crops, silviculture).
- Consider protecting burrows with a framing device that will allow full access for cattle to graze without collapsing the burrow. Select a low and open design that does not impede visibility for burrowing owls.
- Follow the Agricultural Wildlife Best Management Practices (Florida Department of Agriculture and Consumer Services 2015) which recommend avoiding contact with known or visibly apparent burrowing owls year-round, locating concentrated heavy equipment operations away from known or visibly apparent active burrows, and marking and avoiding damage to burrow openings when heavy equipment operations must be located near burrows.

Burrowing owls that occupy the Preservation areas are accustomed to current agricultural practices. Implementing the FWC conservation measures should avoid, or limit to a discountable probability, the death or injury of burrowing owls caused by these practices. We expect the 20,913 acres of the suitable burrowing owl habitat located in the Preservation areas to support about 52 owls (20,913 acres × 0.00246 owls/acre). All 52 owls would experience occasional disturbance from land management practices conducted near burrows.

We expect burrowing owls to persist in the Preservation Area, because the preservation and management activities will, at minimum, maintain the conditions that have allowed owls to colonize these areas from their historic dry prairie habitats of central Florida. Special attention to this species in the long-term management of the Preservation area could likely increase owl densities and the total population, which we expect are currently low. However, lacking detailed information about burrowing owls in the Plan Area, and about how the habitat management may specifically benefit this species, we are unable to estimate the extent of potential benefits.

9.3.3 Very Low Density Development

The Very Low Density (VLD) use areas (total area 2,667 acres) contain about 743 acres of burrowing owl habitat (improved pasture and rural open lands). Land uses include isolated residences, lodges, and hunting/fishing camps, limited to no more than one dwelling unit per 50 acres. Otherwise, the land uses for the VLD areas are the same as for the Preservation areas. Within pastures and rural open areas, where burrowing owls may occur, the Applicants would continue current ranching/livestock operations and other management activities as described for the Preservation Areas (*e.g.,* exotic species control, prescribed burning). The Applicants propose to implement the FWC (2018) conservation measures for burrowing owls, which should avoid, or limit to a discountable probability, the immediate death or injury of burrowing owls in their burrows caused by agricultural or low-density development activities.

We expect habitats of the VLD areas to support at most a single pair of owls (743 acres × 0.00246 owls/acre = 1.83 owls) that would likely share one or more burrows within a common a foraging area of about 280 acres, based on the foraging distances documented for western burrowing owls (see section 9.1.4). The HCP does not specify a footprint for isolated residences, lodges, and hunting/fishing camps, but indicates that their construction could involve clearing up to 10% of the 1,180 acres (118 acres) of existing native vegetation (see section 2.5). Native upland habitats that the burrowing uses (*e.g.,* dry prairie) are not present in the VLD areas or anywhere else in the Plan Area. New dwelling construction in non-native cover types is not specifically proposed, but not precluded.

The 118-acre cap for native vegetation clearing is the only indication the HCP provides for the maximum extent of potential land alteration associated with new dwelling development in the VLD areas. This maximum footprint represents 118 acres ÷ 2,667 acres = 4.4% of the VLD areas. The foraging area for a single pair of owls represents 280 acres ÷ 2,667 acres = 10.5% of the VLD areas. The probability that dwelling development would overlap the owl foraging area is the product of these percentages (0.5%), which we consider discountable for purposes of this assessment. In the unlikely event that dwelling development overlaps the range of an owl pair, we do not expect any resulting shift in their home range to actually kill or injure either individual. The local availability of pastures and open rural lands in the VLD areas (743 acres) is substantially greater than the needs of a single pair, such that shifting foraging activity away from a new dwelling is unlikely to impair feeding behaviors.

9.4 Cumulative Effects on Florida Burrowing Owl

For purposes of consultation under ESA §7, cumulative effects are those caused by future state, tribal, local, or private actions that are reasonably certain to occur in the Action Area. Future Federal actions that are unrelated to the proposed action are not considered, because they require separate consultation under §7 of the ESA.

We identified in section 3 of this BO/CO a projected increase in traffic on public roads as the sole source of effects that are consistent with the definition of cumulative effects for this Action. Roadkill is a known cause of Florida burrowing owl mortality, especially in urban areas. An increase in traffic on Action Area roads could increase roadkill rates for owls where roads cross or adjoin occupied areas; however, we have no data upon which to develop a reasonable relationship between traffic volume and owl mortality.

9.5 Conclusion for Florida Burrowing Owl

In this section, we summarize and interpret the findings of the previous sections for the Florida burrowing owl (status, baseline, effects, and cumulative effects) relative to the species-specific purpose of a BO under §7(a)(2) of the ESA, which is to determine whether the proposed action is likely to jeopardize the continued existence of a species.

Status

The dry prairies of central Florida provided the species' historic habitats, but development in these areas has caused a range expansion to the north and south, and to the coasts. Non-native habitats now include pastures, agricultural fields, golf courses, airports, school yards, and vacant lots in residential areas. The current range-wide abundance of the Florida burrowing owl is unknown. In 1996, estimated abundance was 3,000–10,000 burrowing owls. More recent data from Marco Island and Cape Coral document at least 4,100 burrowing owls in these two populations.

A continuing loss of native habitat and the resulting reliance on non-native habitat is a threat to the species, due to the many unique hazards of the urban environment. Urban settings expose owls to foraging habitat and burrow destruction caused by construction activity, frequent disturbance by domestic animals and people, rodenticides and other contaminants, collisions with vehicles, and predation by native and exotic wildlife. The frequency and severity of these stressors are likely reduced in rural settings, but cattle grazing at high stocking densities is an additional stressor. The primary conservation need for the species is increased habitat protection and management, as described in the S*pecies Conservation Measures and Permitting Guidelines for the Florida Burrowing Owl* (FWC 2018).

Baseline

The Plan Area contains up to 48,988 acres of land cover that is suitable habitat for burrowing owls, which includes improved pasture, rural open land, and cropland/pasture. Native upland habitats that the burrowing owl uses (*e.g.,* dry prairie) are not present in the Plan Area. Given known locations within and near the Plan Area, large dispersal distances, and the presence of suitable non-native habitat, we are reasonably certain that burrowing owls occupy the Plan Area. Using the density of Florida burrowing owls documented in studies for the Ave Maria development (11 owls ÷ 4,466 acres = 0.00246 owls/acre), we estimate that the Plan Area supports up to 121 burrowing owls.

Threats to the Florida burrowing owl in the Action Area are the same as the range-wide threats, and the primary conservation need is habitat protection and better land management.

Effects

The extent of burrowing owl cover types (improved pasture, rural open land, and cropland/pasture) within the designated Development areas, Base Zoning, and Eligible lands is 27,332 acres, which is less than the development cap of 39,973 acres. High-density development confined entirely to the Development areas, or implemented with the maximum possible substitution of Base Zoning and/or Eligible lands in the accounting for the cap, could replace all burrowing owl habitat in one or more of these HCP land use designations.

We estimate that up to 67 owls (27,332 acres × 0.00246 owls/acre) occupy the lands within the potential development envelope of the HCP. Pre-construction owl surveys and buffers around burrows should avoid the immediate death and injury caused by burrow destruction. However, we expect that full HCP development would cause all 67 owls to experience a loss of foraging habitat and/or disturbance that would eventually displace them to other areas of suitable habitat. A substantial, but undeterminable percentage of those that survive the hazards associated with displacement would likely experience the injury of reduced reproductive success until established elsewhere. Therefore, we expect take in the form of harm (habitat modification that actually causes subsequent death or injury) of up to 67 owls in the Development, Mining, Base Zoning, and Eligible Lands areas, depending on the distribution of 39,973 acres of high-density development.

The Preservation areas contain 20,913 acres of suitable burrowing owl habitat, which we expect to support 52 owls (20,913 acres x 0.00246 owls/acre). We expect burrowing owls to persist in the Preservation areas, because the preservation and management activities will, at minimum, maintain the conditions that have allowed owls to colonize these non-native habitats. Special attention to this species in the long-term management of the Preservation Area would likely increase owl densities and the total population; however, we are unable to estimate the extent of potential benefits. We do not expect Covered Activities in the Very Low Density use areas, which may support a single pair of owls, to harm them.

Cumulative Effects

An increase in traffic on Action Area roads could increase roadkill rates for owls where roads cross or adjoin occupied areas; however, we have no data upon which to develop a reasonable relationship between traffic volume and owl mortality.

Opinion

The possible death of up to 67 owls would represent a 0.7–1.6 percent reduction in the Florida-wide population of burrowing owls, relative to a maximum estimate of about 10,000 owls and a minimum of 4,100 in the Marco Island and Cape Coral populations, respectively. However, we believe that a substantial percentage of owls displaced by development activity would survive and then experience a temporary reduction in reproductive success, because suitable non-native habitat in the overall Plan Area is relatively abundant. Population increases in the Preservation areas could wholly or partially offset the loss of individuals and productivity caused by development activity, but would depend on the success of management in these areas, which we believe is likely, but not guaranteed. The Preservation areas could probably support a much higher owl density with management. Cumulative effects caused by an increase in Action Area traffic are possible, but not determinable.

The species has demonstrated an ability to colonize non-native habitats, including urban and suburban developments, pastures, and open rural lands, which occur throughout the Plan Area. Agricultural lands (and native habitats) in the Preservation areas would remain undeveloped under permanent easements while about 25% of the Plan Area is developed (39,973 of 159,489 acres). The likely survival of displaced birds and possible increases in habitat quality in the Preservation areas would reduce the overall impact of the Action to the Florida-wide population to a level substantially below the worst-case scenario of a 1.6 percent loss. We believe the net impact of the Action and cumulative effects on the Florida burrowing owl is within the species' ability to sustain.

After reviewing the current status of the species, the environmental baseline for the Action Area, the effects of the Action and the cumulative effects, it is the Service's conference opinion that the Action is not likely to jeopardize the continued existence of the Florida burrowing owl.

10 Red Knot

This section provides the Service's biological opinion of the Action for the red knot.

10.1 Status of Red Knot

This section summarizes best available data about the biology and current condition of the red knot (*Calidris canutus rufa*) throughout its range that are relevant to formulating an opinion about the Action. The Service published its decision to list the red knot as threatened on December 11, 2014 (79 FR 73705–73748). The Service has not proposed or designated critical habitat for the red knot at this time.

10.1.1 Species Description

The red knot (or "rufa red knot") is a medium-sized shorebird about 9–11 inches in length that is named for the distinctive rufous (red) breeding plumage of its face, breast, and upper belly. Winter plumage is a pale ashy gray from crown to rump, with white underparts, a lightly streaked and speckled breast, and narrowly barred gray flanks. The red knot has a small head in proportion to its size, small eyes, and a short neck. Its straight black bill tapers from a stout base to a relatively fine tip and is slightly longer than its head. Legs are short and typically dark gray to black, but sometimes greenish in juveniles or older birds in nonbreeding plumage.

10.1.2 Life History

The red knot migrates annually between its tundra breeding grounds in the Canadian Arctic and coastal wintering regions along the Gulf of Mexico, south Atlantic U.S. states, north coast of Brazil, and Tierra del Fuego at the southern tip of South America (Argentina and Chile). The 19,000-mile journey between the Arctic and Tierra del Fuego is one of the longest known animal migrations. During both the northbound (spring) and southbound (fall) migrations, red knots use key staging and stopover areas to rest and feed, primarily in coastal areas.

Small numbers of red knots sometimes use manmade freshwater habitats (*e.g.,* impoundments) along inland migration routes. In Florida, red knots that are either wintering in the state or passing through on migration are most commonly found along sandy, gravel, or cobble beaches, tidal mudflats, mangroves, salt marshes, shallow coastal impoundments, and brackish lagoons (Harrington 2001; Truitt *et al.* 2001; Niles *et al.* 2008; Cohen *et al.* 2009, 2010).

In shoreline settings, red knot eats hard-shelled mollusks, sometimes supplemented with easily accessed softer invertebrate prey, such as shrimp- and crab-like organisms, marine worms, and horseshoe crab eggs (Piersma and van Gils 2011; Harrington 2001). On its Arctic breeding grounds (dry, slightly elevated tundra located near coasts), the red knot's diet consists mostly of terrestrial invertebrates such as insects and other arthropods. However, early in the breeding season, before insects and other macroinvertebrates are active and accessible, the red knot will eat grass shoots, seeds, and other vegetable matter (Harrington 2001). Diets during stopovers at inland wetlands are unknown.

10.1.3 Numbers, Reproduction, and Distribution

A current, reliable, range-wide population estimate for the red knot is not available. Red knots breed across a huge and remote area of the Arctic. Regional counts of red knots in wintering areas and migration stopovers provided the primary evidence of a significant declining trend in numbers that prompted the Service's review of the species' status (USFWS 2014). Major coastal wintering areas include the southern tip and northern coast of South America, the Gulf of Mexico, and south Atlantic U.S. states. Delaware Bay is recognized as the primary Atlantic stopover in spring migration. The estimated passage population through Delaware Bay declined from 152,900 birds in 1989 to 48,955 birds in 2013 (USFWS 2014).

Information about red knot numbers and distribution along the Gulf coast of peninsular Florida is most relevant to this BO. The highest concentration of red knots wintering in Florida occurs in the greater Tampa Bay region. Annual winter aerial surveys along Florida's Gulf coast from 2006 to 2010 counted an average of 1,451 red knots between Anclote Key (north of Clearwater) and Cape Romano (south of Naples) (Niles 2009; Dey *et al.* 2011). Corresponding ground counts in 2006, 2008, and 2009 were roughly comparable (within 6–11%) to the aerial counts.

10.1.4 Conservation Needs and Threats

The Service (2014) summarized threats to the red knot in our review of data for the final listing rule. Threats from habitat destruction and modification are occurring throughout its range, including climate change (especially sea level rise), shoreline stabilization, and coastal development, exacerbated regionally or locally by lesser habitat-related threats such as beach cleaning, invasive vegetation, agriculture, and aquaculture. Reduced food availability at the Delaware Bay stopover site due to commercial harvest of the horseshoe crab likely contributed to the decline of red knot populations in the 2000s.

10.2 Environmental Baseline for Red Knot

This section describes the current condition of the red knot in the Action Area without the consequences to the listed species caused by the proposed Action.

10.2.1 Action Area Numbers, Reproduction, and Distribution

Our only data for red knot use of the Plan Area are three sightings in the winter of 2016, and one in the winter of 2017, documented in eBird (2019). The 2016 sightings were in large fields (total extent about 75 acres) that were intentionally flooded to suppress weed growth. During the growing season, these fields produce tomatoes. The 2017 sighting was in an unspecified upland cover class. We believe small numbers of red knots, not large flocks, may use portions of the Plan Area occasionally when displaced inland by severe weather, disturbance, or other alterations of nearby coastal habitats, possibly following other species of shorebirds that more commonly use inland fields. Red knots red knots are well documented along the Gulf shoreline of Estero Island, Lovers Key, Long Key, Marco Island, and to a lesser extent Naples Beach.

The Plan Area contains pond/lake shorelines and non-forested wetlands that may occasionally provide foraging and resting stopovers for red knots. The 2017 red knot sighting in an upland habitat was atypical, and we do not consider uplands of the Plan Area as potential red knot habitat. Lacking evidence that red knots regularly use any portion of the Plan Area, we consider the 75 acres of periodically flooded agricultural fields as the sole area that supports occasional red knot use.

10.2.2 Action Area Conservation Needs and Threats

The Action Area does not contain coastal habitats that red knots most commonly use for wintering in and migrating through Florida; therefore, the suite of threats to such habitats in the range-wide context are not relevant in the Action Area. Conserving inland non-forested wetlands would benefit red knots that occasionally use them as short-term alternatives to coastal habitats.

10.3 Effects of the Action on Red Knot

This section describes all reasonably certain consequences to the red knot that we predict the proposed Action would cause, including the consequences of other activities not included in the proposed Action that would not occur but for the proposed Action. Such effects may occur later in time and may occur outside the immediate area involved in the Action.

10.3.1 Development and Mining, Base Zoning, and Eligible Lands

The 75 acres of winter-flooded tomato fields in which red knots were sighted in 2016 are within a designated Development area of the HCP. As an agricultural cover type that could plausibly receive a disproportionate share of development under the 39,973-acre development cap, the "reasonable maximum impact" method described in section 2.1.4 is appropriate. The size of the only known red knot habitat within the Plan Area is substantially less than 39,973 acres; therefore, we consider that commercial/residential development would affect all 75 acres.

Development of these fields would eliminate seasonal flooding practices, which makes the fields attractive to shore birds venturing inland, and convert the cropland to urban cover. Development would occur necessarily when the fields are not flooded and when red knots are not present. The area would no longer support use by red knots; however, we do not expect this habitat loss to kill or injure any red knots. We believe the use of the flooded fields is opportunistic, and that sufficient lake, pond, and wetland shorelines are available in the general area to serve occasional and opportunistic use when red knots may wander inland from traditional coastal habitats.

10.3.2 Preservation Activities

The 2017 sighting of a single red knot in the Plan Area was at an upland site within a designated Preservation area. As a shorebird that winters in and migrates through Florida primarily along its coastlines, the use of inland areas appears occasional and unpredictable. We do not consider uplands or wetlands of the Plan Area to provide substantial habitat value for the red knot. However, by continuing current agricultural uses and precluding future commercial/residential development and earth mining, the Preservation areas would remain available for occasional red knot use. Otherwise, we expect the Covered Activities in the Preservation areas to have no effect on the species.

10.3.3 Very Low Density Development

We have no data that the red knot has used or is reasonably certain to use the areas designated for Very Low Density development. For the same reasons we provided in the previous section, we expect the Covered Activities in these areas to have no effect on the red knot.

10.3.4 Cumulative Effects on Red Knot

For purposes of consultation under ESA §7, cumulative effects are those caused by future state, tribal, local, or private actions that are reasonably certain to occur in the Action Area. Future Federal actions that are unrelated to the proposed action are not considered, because they require separate consultation under §7 of the ESA.

We identified in section 3 of this BO/CO a projected increase in traffic on public roads as the sole source of effects that are consistent with the definition of cumulative effects for this Action. We have no information that suggests traffic on public roads is a predictable cause of red knot injury, mortality, or significant behavioral modification.

10.4 Conclusion for Red Knot

In this section, we summarize and interpret the findings of the previous sections for the red knot (status, baseline, effects, and cumulative effects) relative to the species-specific purpose of a BO under §7(a)(2) of the ESA, which is to determine whether the proposed action is likely to jeopardize the continued existence of a species.

Status

A current, reliable, range-wide population estimate for the red knot is not available. The estimated passage population through Delaware Bay, the primary Atlantic stopover during spring migration, declined from 152,900 birds in 1989 to 48,955 birds in 2013. Numbers on the Gulf coast of peninsular Florida averaged 1,451 red knots in annual winter aerial surveys from 2006 to 2010.

Threats to the coastal habitats of the red knot include climate change (especially sea level rise), shoreline stabilization, and coastal development, exacerbated regionally or locally by lesser habitat-related threats such as beach cleaning, invasive vegetation, agriculture, and aquaculture.

Baseline

Our only data for red knot use of the Plan Area are three sightings in the winter of 2016, and one in the winter of 2017. The 2016 sightings were in large tomato fields (total extent about 75 acres) that were intentionally flooded to suppress weed growth. The 2017 sighting was in an unspecified upland cover class. We believe small numbers of red knots, not large flocks, may use portions of the Plan Area occasionally when displaced inland by severe weather, disturbance, or other alterations of nearby coastal habitats, possibly following other species of shorebirds that more commonly use inland fields.

Effects

Development of the 75 acres of flooded tomato fields that have supported previous red knot use would eliminate seasonal flooding practices, which makes the fields attractive to shore birds venturing inland, and convert the cropland to urban cover. Development would occur necessarily when the fields are not flooded and when red knots are not present. The fields would no longer support use by red knots; however, we do not expect this habitat loss to kill or injure any red knots. We expect the Covered Activities in the Preservation and Very Low Density Development areas to have no effect on the species.

Cumulative Effects

We do not anticipate coextensive non-federal actions within the Action Area unrelated to the HCP that would affect the red knot.

Opinion

Red knots infrequently occur in the Plan Area, likely at a very low density and a patchy distribution. The development activity could convert approximately 75 acres of tomato fields, which are periodically flooded for weed control, to residential and commercial development. Red knots have used these fields for foraging and roosting. Although this habitat conversion would permanently preclude such use in the future, we do not expect the habitat loss to kill or injure any red knots or otherwise reduce the likelihood of the species' survival and recovery.

After reviewing the current status of the species, the environmental baseline for the Action Area, the effects of the Action and the cumulative effects, it is our biological opinion that the Action is not likely to jeopardize the continued existence of the red knot.

11 Little Blue Heron

This section provides the Service's conference opinion of the Action for the little blue heron.

11.1 Status of Little Blue Heron

This section summarizes best available data about the biology and current condition of the little blue heron (*Egretta caerulea*) (LBH) throughout its range that are relevant to formulating an opinion about the Action. At this time, the LBH is not protected under the ESA. The Service has not reviewed the species' status relative to the ESA definitions of "endangered" and "threatened." The State of Florida protects the LBH as a threatened species under Florida's Endangered and Threatened Species Rule. For purposes of this Conference Opinion, we rely upon the Biological Status Review prepared by the Florida Fish and Wildlife Conservation Commission (FWC 2011) and other available data to describe the species' status.

11.1.1 Species Description

The LBH is a small wading bird species that can reach a length of up to 29 inches, a wingspan of 41 inches, and a weight of 14 ounces. Little blue herons have a grayish-blue body and a dark red head during breeding, and a purplish head and neck during non-breeding periods.

11.1.2 Life History

Rodgers and Smith (2012) synthesized available data about the biology of the LBH, which is the source of information we provide here. The LBH is a colonial-nesting wading bird that forages and breeds in a variety of freshwater and marine-estuarine habitats. Northern breeding populations are migratory, and others are year-round residents.

Nesting usually occurs in colonies, sometimes with thousands of other wading birds, on islands, thickets near water, or emergent vegetation over water. LBHs produce one brood per season, laying clutches of three to five eggs that hatch in 20–24 days. Young fledge at 28 days. Suitable breeding sites have woody vegetation that can support nests, absence of ground-predators, and proximity to foraging habitat.

Typical prey items fish, insects, crustaceans, and amphibians. Foraging habitats include tidal ponds and sloughs, mudflats, mangrove-dominated pools, freshwater sloughs and marshes, the edges of rivers, streams, and lakes, and canals and impoundments. Flight distance to foraging sites from nesting colonies is variable, probably as a function of food availability. The average distance traveled from an interior (not coastal) freshwater colony to foraging sites in Florida was 6.7 km (4.2 miles).

11.1.3 Numbers, Reproduction, and Distribution

The LBH is widely distributed in the Americas and Caribbean (Rodgers and Smith 2012). Its contiguous U.S. breeding range extends along the Atlantic coast from southern Maine to Florida, along the Gulf Coast from Florida to Texas, and inland as far north as southern Illinois and central Kentucky. Breeding also occurs on the west side of North America in California and Mexico. LBH that breed in northern portions of the range migrate south in the fall to various wintering areas, including Florida. Rodgers and Smith (2012) report that the LBH appears most abundant in Delaware, North Carolina, South Carolina, Florida, Texas, and especially Louisiana, but a range-wide population estimate is not available.

FWC (2011) cited an unpublished report that identified wading bird nesting colonies in south Florida that supported more than 2,000 LBH pairs in 2009. FWC believes the statewide population is between 5,000–15,000 individuals, and reports indications that LBH numbers have exhibited a slow but steady decline since the latter 1990s. The LBH occurs throughout Florida in wetland habitats of all nearly all types, but more commonly in freshwater types.

11.1.4 Conservation Needs and Threats

Current threats to the species are degradation or loss of habitat, hydrologic alterations to wetlands, and reductions to important prey sources. FWC (2013) suggested that prey availability is the most important factor limiting the populations of several wading birds, including the LBH. Human disturbance at nesting colonies, increased pressure from predators, oil spills, and exposure to other contaminants are additional recognized threats (FWC 2011). Rodgers and Smith (2012) cite studies that suggest that competition for nesting habitat with cattle egrets has contributed to reduced LBH productivity.

Conservation needs include hydrological restoration, management of suitable habitat, and removal of non-native species.

11.2 Environmental Baseline for Little Blue Heron

This section describes the current condition of the LBH in the Action Area without the consequences to the listed species caused by the proposed Action.

11.2.1 Action Area Numbers, Reproduction, and Distribution

The Applicants did not conduct species-specific surveys for the LBH within the Plan Area, but note in section 5.5.1.4 of the HCP that the species is routinely observed in the Plan Area. The Plan Area contains 58,543 acres of native freshwater wetlands that are potential LBH habitat (Table 2-2). In 1996, freshwater wetlands covered about 10.2 million acres of Florida, and the rate of wetlands loss in the previous decade was about 5,000 acres annually (Dahl 2005). Extrapolating this rate of loss to 2019 yields about 10 million acres statewide. The statewide LBH population of about 5,000–15,000 individuals (FWC 2011) in about 10 million acres of wetlands in Florida is a density of one bird per 667–2,000 acres of habitat. We apply this density to the wetland acreage of the Plan Area to estimate that 29–88 LBH occur within the Plan Area.

The Florida Fish and Wildlife Research Institute has identified two active wading bird colonies within the Plan Area that support LBH nesting (FWRI 2018) of less than 10 nesting pairs per colony. The two known colonies are located within areas designated for Preservation near the northeast corner of the Plan Area. Whether other active nesting sites for LBH occur in the Plan Area is unknown. Up to 10 pairs in only two colonies would amount to 40 adults, which is within the density-based range of 29–88 adults that we expect the Plan Area wetlands to support.

11.2.2 Action Area Conservation Needs and Threats

Large areas of native wetlands habitat within the Plan Area have been altered via land clearing and drainage for agricultural uses. This loss of habitat has reduced prey availability and likely increased competition with other wading birds. Like other cattle grazing areas in Florida, the Plan Area supports a population of cattle egrets, which may compete with LBH for nesting sites. Threats to the LBH within the Plan Area include further habitat loss and degradation, and disturbance at breeding and foraging sites. Conservation needs within the Plan Area include the protection and management of existing suitable habitat, especially colonial nesting sites, and the hydrologic restoration of degraded wetlands.

11.3 Effects of the Action on Little Blue Heron

This section describes all reasonably certain consequences to the LBH that we predict the proposed Action would cause, including the consequences of other activities not included in the proposed Action that would not occur but for the proposed Action. Such effects may occur later in time and may occur outside the immediate area involved in the Action.

11.3.1 Development and Mining, Base Zoning, and Eligible Lands

To estimate the spatial extent of development across cover classes the LBH may occupy, we use the "Proportional" method described in section 2.1.4, which distributes 39,973 acres of development among all areas (Development and Mining, Base Zoning, and Eligible Lands) that could receive high-density development under the HCP. By this method, we estimate that the proposed Action could convert up to 4,885 acres of wetland habitats to residential, commercial, or mining uses (Table 2-3, sum of column "G" for native wetlands). The designated Development and Mining areas contain 2,442 acres of native wetlands (Table 2-2), which is the maximum loss of wetlands that could occur if development is confined entirely to these areas (*i.e.,* no substitution of Base Zoning or Eligible lands in the development cap). Using densities of one bird per 667–2,000 acres of habitat (see section 11.2.1), 2,442–4,884 acres of wetlands would support about 2–8 LBH.

Development and mining in wetlands would involve various activities (drainage, filling, excavation, paving, building construction, *etc.*) that would permanently eliminate the affected areas as LBH habitat. The two known LBH nesting colonies within the Plan Area are within designated Preservation areas; therefore, we do not expect development activities to directly kill or injure LBH eggs or flightless young. However, development of wetlands used as foraging areas would cause 2–8 LBH to forage elsewhere.

We would expect habitat alteration that causes displacement from foraging areas to harm (actually kill or injure) LBH individuals indirectly through reduced reproductive success if it substantially reduces prey availability within the typical foraging distance from colonial nesting sites (average of about 4.2 miles; see section 11.1.2). Due to the uncertain distribution of 39,973 acres of development within a 66,245-acre envelope (total extent of the Development and Mining, Base Zoning, and Eligible Lands), we are unable to determine the extent of development that would occur within 4.2 miles of the two known active LBH nesting colonies. These nesting sites are located in designated Preservation areas near the northeast corner of the Plan Area about 4 miles from the nearest designated Development area. This quadrant of the Plan Area contains the Base Zoning parcel and two parcels of the Eligible Lands, and these areas may substitute for designated Development areas in the development cap. However, Preservation is the designated use for most of the area surrounding the nesting sites, and the Preservation areas contain 84.9% of the native wetlands in the Plan Area (see Table 2-2). We believe it is unlikely that a potential loss of foraging habitat in the Base Zoning and Eligible Lands in this quadrant of the Plan Area would impair LBH reproductive success, but we acknowledge that prey availability is considered an important factor limiting LBH and other wading bird populations (FWC 2013).

The Applicants propose to mitigate for permanent losses of habitat for Covered wading bird species through "preservation, and potential restoration, enhancement and/or creation of an equal acreage of in-kind little blue heron and tricolored heron habitat" (HCP chapter 7.5.1.4). In its "Species Conservation Measures and Permitting Guidelines," FWC (2019) considers wetland mitigation through the State's Environmental Resource Permit (ERP) process sufficient to satisfy its permitting requirements for potential take of LBH caused by significant modification of foraging habitat. We expect that the developments of the HCP would engage the State's ERP process.

11.3.2 Preservation Activities

The designated Preservation areas of the HCP contain 49,695 acres of native wetlands (Table 2-1) that we consider LBH foraging and nesting/roosting habitat. Using densities of one bird per 667–2,000 acres of habitat (see section 11.2.1), these wetlands would support about 25–75 LBH. The two sites known to support recent LBH nesting activity within the Plan Area are located within Preservation areas.

The Applicants propose a continuation of existing land uses (agriculture, silviculture, *etc.*) in the Preservation areas, which we listed in section 2.3. All of these uses may occur to some extent in native wetlands of the Preservation areas except crop cultivation. Land management activities in the Preservation areas for which the Applicants seek take authorization and that may occur in wetlands include:

- prescribed burning;
- mechanical control of groundcover (*e.g*., roller chopping, brush-hogging, mowing);
- ditch and canal maintenance;
- mechanical and/or chemical control of exotic vegetation; and
- similar activities that maintain or improve land quality.

In wetlands, prescribed burning is usually applied to control woody encroachment in non-forested wetlands (*e.g.,* wet prairies and bogs), which do not ordinarily support LBH nesting. Therefore, we do not expect prescribed fire to harm LBH. The other activities listed above may temporarily disrupt LBH foraging activity, but are unlikely to harm birds unless conducted near nesting sites. We believe that trees surrounded by standing water, the typical setting of a colonial wading bird rookery, are unlikely locations for these land management actions.

We do not expect the management of Preservation areas to reduce the numbers, reproduction, or distribution of the LBH in the Preservation areas, because these activities would, at minimum, maintain current conditions. Special attention to this species in the long-term management of the Preservation areas under conservation easements could increase LBH densities and the Plan Area population. However, lacking detailed information about the LBH in the Plan Area, and about how habitat management under conservation easements may benefit this species, we are unable to estimate the extent of potential benefits.

11.3.3 Very Low Density Development

The Very Low Density (VLD) use areas of the HCP contain 733 acres of native wetlands that we consider as LBH habitat (Table 2-2). Using densities of one bird per 667–2,000 acres of habitat (see section 11.2.1), these wetlands would support less than two LBH. No sites known to support recent LBH nesting activity within the Plan Area are located within the VLD areas.

Land uses in the VLD areas are similar to the Preservation areas, but may also include isolated residences, lodges, and hunting/fishing camps, at a density of no more than one dwelling unit per 50 acres. The Applicants would continue current ranching/livestock operations and other management activities as described for the Preservation Areas (*e.g.,* exotic species control, prescribed burning). As in the Preservation areas, we do not expect adverse effects resulting from the continuation of the existing land management regimes.

The HCP does not specify a footprint for the isolated residences, lodges, and hunting/fishing camps, but indicates that their construction could clear up to 10% of the existing native vegetation (see section 2.5). New dwelling development could occur within any of the cover types present besides open water and existing development. Clearing up to 10% of the native cover types that we consider as LBH habitat would reduce such habitat by 73 acres (Table 2-7). It is possible that dwelling development in the VLD areas could entirely avoid wetlands, but we conservatively estimate a 73-acre habitat loss. Because the VLD area wetlands do not support known nesting colonies, we do not expect this extent of habitat modification to kill or injure LBH.

The general measures for enhancing LBH habitat in the Preservation areas apply to the VLD areas as well (see previous section 11.3.2). However, the potential to increase LBH numbers or reproduction is limited due to the small extent of wetlands in the VLD areas.

11.4 Cumulative Effects on Little Blue Heron

For purposes of consultation under ESA §7, cumulative effects are those caused by future state, tribal, local, or private actions that are reasonably certain to occur in the Action Area. Future Federal actions that are unrelated to the proposed action are not considered, because they require separate consultation under §7 of the ESA.

We identified in section 3 of this BO/CO a projected increase in traffic on public roads as the sole source of effects that are consistent with the definition of cumulative effects for this Action. We have no information that suggests traffic on public roads is a predictable cause of LBH injury, mortality, or significant behavioral modification.

11.5 Conclusion for Little Blue Heron

In this section, we summarize and interpret the findings of the previous sections for the LBH (status, baseline, effects, and cumulative effects) relative to the species-specific purpose of a BO under §7(a)(2) of the ESA, which is to determine whether the proposed action is likely to jeopardize the continued existence of a species.

<u>Status</u>

The LBH is widely distributed in the Americas and Caribbean. A range-wide estimate of abundance is not available. The Florida population is between 5,000–15,000 individuals, and has slowly but steadily declined since the 1990s. The LBH occurs throughout Florida in wetland habitats of all nearly all types, but more commonly in freshwater types. Current threats to the species are degradation or loss of habitat, hydrologic alterations to wetlands, and reductions to important prey sources. Prey availability is an important factor limiting the populations of several wading birds, including the LBH. LBH conservation needs include hydrological restoration, management of suitable habitat, and removal of non-native species.

Baseline

The Plan Area contains 58,543 acres of native freshwater wetlands that are potential LBH habitat. The statewide LBH population of about 5,000–15,000 individuals in about 10 million acres of wetlands in Florida is a density of one bird per 667–2,000 acres of habitat. We apply this density to the wetland acreage of the Plan Area to estimate that 29–88 LBH occur within the Plan Area. Two active wading bird colonies within the Plan Area support LBH nesting of less 10 nesting pairs per colony. Whether other active nesting sites for LBH occur in the Plan Area is unknown. LBH conservation needs within the Plan Area include the protection and management of existing suitable habitat, especially colonial nesting sites, and the hydrologic restoration of degraded wetlands.

Effects

Depending on the distribution of the development cap among the Development and Mining, Base Zoning, and Eligible Lands designations of the HCP, we estimate the development would eliminate 2,442–4,884 acres of wetlands that would support foraging for about 2–8 LBH. The two known LBH nesting colonies within the Plan Area are within designated Preservation areas; therefore, we do not expect development activities to directly kill or injure LBH eggs or flightless young. Based on the distance of these colonies from potential development activity, we believe it is unlikely that the loss of foraging habitat within the development envelope would impair LBH reproductive success at these colonies.

The designated Preservation areas may support 25–75 LBH. We do not expect the management of Preservation areas to reduce the numbers, reproduction, or distribution of the LBH in the Preservation areas, because these activities will, at minimum, maintain current conditions. Special attention to this species in the long-term management of the Preservation areas under conservation easements could increase LBH densities and the Plan Area population.

Native wetlands in the Very Low Density (VLD) use areas may support less than two LBH. Clearing up to 10% of the native wetlands in the VLD use areas would reduce LBH habitat by 73 acres. Because the VLD area wetlands do not support known nesting colonies, we do not expect this extent of habitat modification to kill or injure LBH.

Opinion

The loss of about 2,442–4,884 acres of wetlands that may support LBH foraging would add an increment of habitat loss to the species' range in Florida, where numbers have been declining due primarily to habitat loss since the 1990's. Foraging habitat reductions near nesting colonies may impair reproductive success, but the only two known active LBH colonies in the Plan Area are not within or near designated Development areas that are most likely to receive development. However, prey availability is recognized as a primary factor limiting LBH populations. Using the statewide FBH density as a measure of the impact of wetlands loss on LBH populations, the development could reduce LBH numbers by 2–8 individuals. Relative to statewide numbers of 5,000–15,000, this represents a 0.01–0.16% reduction. Range-wide abundance throughout the

Americas and Caribbean is unknown, but likely several orders of magnitude greater than the Florida population.

Precluding new development and mining activity in the dedicated Preservation areas would protect 49,695 acres of LBH habitat, which contains 85% of the Plan Area wetlands. As these areas are brought under conservation easements, habitat enhancements that may increase LBH numbers are likely, but the amount or extent is not predictable at this time. Given the relatively small proportional impact of the Development activities to Florida LBH populations, and a much smaller proportional impact range-wide, we believe the net impact of the Action on the LBH is within the species' ability to sustain.

After reviewing the current status of the species, the environmental baseline for the Action Area, the effects of the Action and the cumulative effects, it is the Service's conference opinion that the Action is not likely to jeopardize the continued existence of the LBH.

12 Tricolored Heron

This section provides the Service's conference opinion of the Action for the tricolored heron.

12.1 Status of Tricolored Heron

This section summarizes best available data about the biology and current condition of the tricolored heron (*Egretta tricolor*) (TCH) throughout its range that are relevant to formulating an opinion about the Action. At this time, the TCH is not protected under the ESA. The Service has not reviewed the species' status relative to the ESA definitions of "endangered" and "threatened." The State of Florida protects the TCH as a threatened species under Florida's Endangered and Threatened Species Rule. For purposes of this Conference Opinion, we rely upon the Biological Status Review prepared by the Florida Fish and Wildlife Conservation Commission (FWC 2011) and other available data to describe the species' status.

12.1.1 Species Description

The TCH has a dark slate-blue colored head and upper body, a purple chest, and white underparts. This wading bird has a long and slender neck and bill, and reaches a length between 24–26 inches with a wingspan of approximately 36 inches (FWC 2011).

12.1.2 Life History

Frederick (2013) synthesized available data about the biology of the TCH, which is the source of information we provide here. The TCH is a colonial-nesting wading bird that breeds and forages mostly in coastal wetlands, but also in freshwater wetlands. Northern breeding populations are migratory, and others are year-round residents.

Nesting generally occurs on islands or areas of higher ground that support small trees or shrubs surrounded by open water or inundated wetland vegetation. Nesting is typically in mixed-species colonies, and sometimes in small (2–100 pairs) monospecific colonies. TCH feed mostly on small fishes (*e.g.,* topminnows and killifishes). The size of foraging areas fluctuate throughout the year, shrinking during the breeding season to an average radial distance of about 8 miles from a nest location.

12.1.3 Numbers, Reproduction, and Distribution

The breeding range of the TCH parallels the coasts of the U.S. Atlantic states, Gulf of Mexico, southern California and Baja California, Central America, both Atlantic and Pacific coasts of northern South America, and the Caribbean (Frederick 2013). Frederick (2013) speculates that the TCH was likely the most numerous North American heron before the arrival of the cattle egret (*Bubulcus ibis*) in the 1950s. The TCH was considered one of the most common herons in Florida before the 1970s, where the species still occurs throughout most of the state in both freshwater and estuarine habitats (FWC 2011).

A range-wide population estimate is not available. Comprehensive surveys of the U.S. breeding range in 1976 suggested a minimum breeding population of about 193,600 adults, distributed as follows: Louisiana (72%), Texas (12%), Florida (6.3%), and Atlantic coastal states north of Florida (9.7%) (Frederick 2013). Most data collected since that time suggest that the species is declining, perhaps rapidly. FWC (2011) estimated the statewide population at about 10,000 individuals. Citing various reports, FWC (2011) indicated that numbers of TCH nesting in south Florida Water Conservation Areas and Everglades National Park (not statewide) declined from about 10,000–15,000 pairs in the 1930's, to 1,723 pairs in 1999, and to 1,144 pairs in 2009.

12.1.4 Conservation Needs and Threats

Citing various sources, FWC (2013) lists loss of wetland habitat, habitat degradation due to changes in hydrology and water quality, disturbance at breeding sites, and elevated populations of native and non-native nest predators as the primary threats to the TCH. Frederick (2013) suggested that reduced productivity caused by reduced flow of fresh water to the estuaries associated with the Everglades is the most important conservation problem for the TCH. This is consistent with the view that prey availability is the most important factor limiting the populations of several wading birds in Florida, including the TCH (FWC 2013). Sea level rise may reduce the availability of nesting islands and coastal foraging habitat (Frederick 2013).

The primary conservation needs of the TCH mirror those of other species of wading birds: maintain and restore wetlands for nesting and foraging, and protect nesting sites from disturbance.

12.2 Environmental Baseline for Tricolored Heron

This section describes the current condition of the TCH in the Action Area without the consequences to the listed species caused by the proposed Action.

12.2.1 Action Area Numbers, Reproduction, and Distribution

The Applicants did not conduct species-specific surveys for the TCH within the Plan Area, but note in section 5.5.1.4 of the HCP that the species is routinely observed in the Plan Area. The FWC Water Bird Locator, a statewide database of known colonial nesting sites since the 1970s for wading birds and other species, does not contain records of TCH nesting colonies within the Plan Area or within 30 miles of Plan Area (FWRI 2019). Without any records of nesting activity in the Plan Area, and given the species' more typical use of coastal wetland nesting sites, we believe that the Plan Area supports TCH foraging and roosting, but is not reasonably certain to support nesting.

The Plan Area contains 58,543 acres of native freshwater wetlands that are potential TCH habitat (Table 2-2). In 1996, freshwater wetlands covered about 10.2 million acres of Florida, and the rate of wetlands loss in the previous decade was about 5,000 acres annually (Dahl 2005). Extrapolating this rate of loss to 2019 yields about 10 million acres statewide. The statewide TCH population of about 10,000 individuals (FWC 2011) in about 10 million acres of wetlands in Florida is a density of one bird per 1,000 acres of habitat. We apply this density to the wetland acreage of the Plan Area to estimate that about 59 TCH occur within the Plan Area.

12.2.2 Action Area Conservation Needs and Threats

Large areas of native wetlands habitat within the Plan Area have been altered via land clearing and drainage for agricultural uses. This loss of habitat has likely reduced prey availability and increased competition with other wading birds. Threats to the TCH within the Plan Area include further habitat loss and degradation. Conservation needs within the Plan Area include the protection and management of existing suitable habitat, and the hydrologic restoration of degraded wetlands.

12.3 Effects of the Action on Tricolored Heron

This section describes all reasonably certain consequences to the TCH that we predict the proposed Action would cause, including the consequences of other activities not included in the proposed Action that would not occur but for the proposed Action. Such effects may occur later in time and may occur outside the immediate area involved in the Action.

12.3.1 Development and Mining, Base Zoning, and Eligible Lands

To estimate the spatial extent of development across cover classes the TCH may occupy, we use the "Proportional" method described in section 2.1.4, which distributes 39,973 acres of development among all areas (Development and Mining, Base Zoning, and Eligible Lands) that could receive high-density development under the HCP. By this method, we estimate that the proposed Action could convert up to 4,885 acres of wetland habitats to residential, commercial, or mining uses (Table 2-3, sum of column "G" for native wetlands). The designated Development and Mining areas contain 2,442 acres of native wetlands (Table 2-2), which is the maximum loss of wetlands that could occur if development is confined entirely to these areas (*i.e.,* no substitution of Base Zoning or Eligible lands in the development cap). Using a density of one bird per 1,000 acres of habitat (see section 12.2.1), 2,442–4,884 acres of wetlands would support about 3–5 TCH.

Development and mining in wetlands would involve various activities (drainage, filling, excavation, paving, building construction, *etc.*) that would permanently eliminate the affected areas as TCH habitat. No known TCH nesting colonies occur within the Plan Area; therefore, we do not expect development activities to directly kill or injure TCH eggs or flightless young. However, development of wetlands used as foraging areas would cause 3–5 TCH to forage elsewhere.

We would expect habitat alteration that causes displacement from foraging areas to harm (actually kill or injure) TCH individuals indirectly through reduced reproductive success if it substantially reduces prey availability within the typical foraging distance from colonial nesting sites (average of about 8 miles; see section 12.1.2). The nearest documented TCH nesting colony is over 30 miles from the Plan Area (FWRI 2019). The Applicants report that TCH are routinely observed in the Plan Area, which suggests that undetected nesting activity occurs somewhere within or near the Plan Area. Lacking evidence that indicates where TCH nesting may occur, we are not reasonably certain that loss of wetlands foraging habitat resulting from the development would impair TCH reproductive success. However, we recognize that prey availability is considered an important factor limiting TCH and other wading bird populations (FWC 2013).

The Applicants propose to mitigate for permanent losses of habitat for Covered wading bird species through "preservation, and potential restoration, enhancement and/or creation of an equal acreage of in-kind little blue heron and tricolored heron habitat" (HCP chapter 7.5.1.4). In its "Species Conservation Measures and Permitting Guidelines," FWC (2019) considers wetland mitigation through the State's Environmental Resource Permit (ERP) process sufficient to satisfy its permitting requirements for potential take of TCH caused by significant modification of foraging habitat. We expect that the developments of the HCP would engage the State's ERP process.

12.3.2 Preservation Activities

The designated Preservation areas of the HCP contain 49,695 acres of native wetlands (Table 2-2) that we consider TCH foraging and roosting habitat. Using a density of one bird per 1,000 acres of habitat (see section 12.2.1), these wetlands would support about 50 TCH. We have no records of TCH nesting in the Preservation areas, but undetected nesting may occur in wetlands of the Plan Area.

The Applicants propose a continuation of existing land uses (agriculture, silviculture, *etc.*) in the Preservation areas, which we listed in section 2.3. All of these uses may occur to some extent in native wetlands of the Preservation areas except crop cultivation. Land management activities in the Preservation areas for which the Applicants seek take authorization and that may occur in wetlands include:

- prescribed burning;
- mechanical control of groundcover (*e.g.*, roller chopping, brush-hogging, mowing);

- ditch and canal maintenance;
- mechanical and/or chemical control of exotic vegetation; and
- similar activities that maintain or improve land quality.

In wetlands, prescribed burning is usually applied to control woody encroachment in non-forested wetlands (*e.g.,* wet prairies and bogs), which do not ordinarily support TCH nesting. Therefore, we do not expect prescribed fire to harm TCH. The other activities listed above may temporarily disrupt TCH foraging activity, but are unlikely to harm birds unless conducted near nesting sites. We believe that trees surrounded by standing water, the typical setting of a colonial wading bird rookery, are unlikely locations for these land management actions.

We do not expect the management of Preservation areas to reduce the numbers, reproduction, or distribution of the TCH in the Preservation areas, because these activities would, at minimum, maintain current conditions. Special attention to this species in the long-term management of the Preservation areas under conservation easements could increase TCH densities and the Plan Area population. However, lacking detailed information about the TCH in the Plan Area, and about how habitat management under conservation easements may benefit this species, we are unable to estimate the extent of potential benefits.

12.3.3 Very Low Density Development

The Very Low Density (VLD) use areas of the HCP contain 733 acres of native wetlands that we consider as TCH habitat (Table 2-2). Using a density of one bird per 1,000 acres of habitat (see section 12.2.1), these wetlands would support one TCH. No sites known to support TCH nesting activity within the Plan Area are located within the VLD areas.

Land uses in the VLD areas are similar to the Preservation areas, but may also include isolated residences, lodges, and hunting/fishing camps, at a density of no more than one dwelling unit per 50 acres. The Applicants would continue current ranching/livestock operations and other management activities as described for the Preservation Areas (*e.g.,* exotic species control, prescribed burning). As in the Preservation areas, we do not expect adverse effects resulting from the continuation of the existing land management regimes.

The HCP does not specify a footprint for the isolated residences, lodges, and hunting/fishing camps, but indicates that their construction could clear up to 10% of the existing native vegetation (see section 2.5). New dwelling development could occur within any of the cover types present besides open water and existing development. Clearing up to 10% of the native cover types that we consider as TCH habitat would reduce such habitat by 73 acres (Table 2-7). It is possible that dwelling development in the VLD areas could entirely avoid wetlands, but we conservatively estimate a 73-acre habitat loss. Because the VLD area wetlands do not support known nesting colonies, we do not expect this extent of habitat modification to kill or injure TCH.

The general measures for enhancing TCH habitat in the Preservation areas apply to the VLD areas as well (see previous section 11.3.2). However, the potential to increase TCH numbers or reproduction is limited due to the small extent of wetlands in the VLD areas.

12.4 Cumulative Effects on Tricolored Heron

For purposes of consultation under ESA §7, cumulative effects are those caused by future state, tribal, local, or private actions that are reasonably certain to occur in the Action Area. Future Federal actions that are unrelated to the proposed action are not considered, because they require separate consultation under §7 of the ESA.

We identified in section 3 of this BO/CO a projected increase in traffic on public roads as the sole source of effects that are consistent with the definition of cumulative effects for this Action. We have no information that suggests traffic on public roads is a predictable cause of TCH injury, mortality, or significant behavioral modification.

12.5 Conclusion for Tricolored Heron

In this section, we summarize and interpret the findings of the previous sections for the TCH (status, baseline, effects, and cumulative effects) relative to the species-specific purpose of a BO under §7(a)(2) of the ESA, which is to determine whether the proposed action is likely to jeopardize the continued existence of a species.

Status

The TCH is widely distributed in the Americas and Caribbean. A range-wide estimate of abundance is not available, but most data suggest that the species is declining, perhaps rapidly. The Florida population is about 10,000 individuals. The TCH occurs throughout Florida in wetland habitats of all nearly all types, but more commonly in coastal areas. Primary threats to the species include loss of wetland habitat, habitat degradation due to changes in hydrology and water quality, disturbance at breeding sites, and elevated populations of native and non-native nest predators. Prey availability is an important factor limiting the populations of several wading birds, including the TCH. Sea level rise may reduce the availability of nesting islands and coastal foraging habitat (Frederick 2013). The primary conservation needs of the TCH mirror those of other species of wading birds: maintain and restore wetlands for nesting and foraging, and protect nesting sites from disturbance.

Baseline

The Plan Area contains 58,543 acres of native freshwater wetlands that are potential TCH habitat. The statewide TCH population of about 10,000 individuals in about 10 million acres of wetlands in Florida is a density of one bird per 1,000 acres of habitat. We apply this density to the wetland acreage of the Plan Area to estimate that about 59 TCH occur within the Plan Area. TCH nesting within the Plan Area is not documented. Given the species' more typical use of coastal wetland nesting sites, we believe that the Plan Area supports TCH foraging, but is not reasonably certain to support nesting. Threats to the TCH within the Plan Area include habitat loss and degradation. Conservation needs within the Plan Area include the protection and management of existing suitable habitat, and the hydrologic restoration of degraded wetlands.

Effects

Depending on the distribution of the development cap among the Development and Mining, Base Zoning, and Eligible Lands designations of the HCP, we estimate the development would eliminate 2,442–4,884 acres of wetlands that would support foraging for about 3–5 TCH. Lacking evidence that indicates TCH nesting occurs within or near the Plant Area, we are not reasonably certain that loss of wetlands foraging habitat resulting from the development would impair TCH reproductive success.

The designated Preservation areas may support about 50 TCH. We do not expect the management of Preservation areas to reduce the numbers, reproduction, or distribution of the TCH in the Preservation areas, because these activities will, at minimum, maintain current conditions. Special attention to this species in the long-term management of the Preservation areas under conservation easements could increase TCH densities and the Plan Area population.

Native wetlands in the Very Low Density (VLD) use areas may support one TCH. Clearing up to 10% of the native wetlands in the VLD use areas would reduce TCH habitat by 73 acres. Because the VLD area wetlands do not support known nesting colonies, we do not expect this extent of habitat modification to kill or injure TCH.

Cumulative Effects

We have no information that suggests traffic on public roads, which is the sole source of cumulative effects we've identified for this Action, is a predictable cause of TCH injury, mortality, or significant behavioral modification.

Opinion

The loss of about 2,442–4,884 acres of wetlands that may support TCH foraging would add an increment of habitat loss to the species' range in Florida, where numbers have been declining, most likely due to wetlands loss and degradation. Foraging habitat reductions near nesting colonies may impair reproductive success, but no known TCH nesting colonies occur within or near the Plan Area. However, prey availability is recognized as a primary factor limiting TCH populations. Using the statewide TCH density as a measure of the impact of wetlands loss on TCH populations, the development could reduce TCH numbers by 3–5 individuals. Relative to statewide numbers of about 10,000, this represents a 0.03–0.05% reduction. Range-wide abundance throughout the Americas and Caribbean is unknown, but likely several orders of magnitude greater than the Florida population.

Precluding new development and mining activity in the dedicated Preservation areas would protect 49,695 acres of TCH habitat, which contains 85% of the Plan Area wetlands. As these areas are brought under conservation easements, habitat enhancements that may increase TCH numbers are likely, but the amount or extent is not predictable at this time. Given the relatively small proportional impact of the Development activities to Florida TCH populations, and a much smaller proportional impact range-wide, we believe the net impact of the Action on the TCH is within the species' ability to sustain.

After reviewing the current status of the species, the environmental baseline for the Action Area, the effects of the Action and the cumulative effects, it is the Service's conference opinion that the Action is not likely to jeopardize the continued existence of the TCH.

13 Wood Stork

This section provides the Service's biological opinion of the Action for the wood stork.

13.1 Status of Wood Stork

This section summarizes best available data about the biology and current condition of the wood stork (*Mycteria americana*) throughout its range that are relevant to formulating an opinion about the Action. The Service published its decision to list the U.S. breeding population of the wood stork as endangered on February 28, 1984 (49 FR 7332–7335). The Service reclassified the species as threatened and established the U.S. breeding population as a distinct population segment on June 30, 2014 (79 FR 37077–37103). The Service has not designated critical habitat for the wood stork.

13.1.1 Species Description

Wood storks are large, long-legged, colonial-nesting wading birds, about 50 inches tall, with a wingspan of 60–65 inches. Adult plumage is white except for black primary and secondary wing feathers and a short black tail. The dark gray head and neck are unfeathered. The bill is black, thick at the base, and slightly decurved. Immature birds are gray and have a yellowish bill.

13.1.2 Life History

The wood storks diet consists mostly of fish (Depkin et al. 1992) that are 1–10 inches long (Kahl 1964; Ogden et al. 1976; Coulter 1987), supplemented occasionally with crustaceans, amphibians, reptiles, mammals, birds, and arthropods (Depkin et al. 1992). Wood storks select foraging sites that provide a high prey density in shallow water, which results in a narrower range of foraging opportunities than for many of the other wading bird species (Gawlik 2002).

Storks begin breeding at 3–4 years old. Wood storks are relatively long-lived (up to about 12 years) and seasonally monogamous, probably forming a new pair bond each breeding season. Female wood storks lay a staggered clutch of 2–5 (average 3) per breeding season, but may lay a second clutch if nest failure occurs early in the breeding season (Coulter et al. 1999). Incubation lasts about 30 days and begins with the first egg laid. Eggs hatch at different times and nestlings vary in size (Coulter et al. 1999). Young fledge in about 8 weeks, but adults feed them at the nest for an additional 3–4 weeks.

Adults feed the young by regurgitating whole fish into the bottom of the nest about 3–10 times per day. Feedings are more frequent when the birds are young (Coulter et al. 1999) and less frequent when wood storks must fly great distances to locate food (Bryan et al. 1995). The entire nesting period for a single pair, from courtship and nest-building through offspring independence, lasts about 100 to 120 days (Coulter et al. 1999). Asynchronous nest initiation within a colony may extend breeding activity for the colony as a whole substantially beyond the 120 days required for a single pair. Adults and independent young may continue to forage around the colony site for a relatively short period following the completion of breeding.

Wood storks are dependent on consistent foraging opportunities in wetlands near nesting colonies for reproductive success. Kahl (1964) estimated that each pair of storks consumes about 443 pounds of fish, crustaceans, and other prey during the nesting season. In south Florida, the Service defines an 18.6-mile radius around a wood stork nesting colony as its core foraging area (CFA).

The seasonal timing of nest initiation is March–May in areas outside of south Florida. Historically, nest initiation in south Florida occurred from November–January, and sometimes as early as October, generally coinciding with the onset of the dry season. The disproportionate loss of short hydro-period wetlands caused by drainage and development activity is most likely responsible for shifting stork nest initiation in the Everglades and Big Cypress areas to February–March in most years since the 1970s. This delay risks an overlap of the nesting season with the onset of the wet season in May– June, when water levels rise and disperse the forage fish that support nesting success.

Following the nesting season, both adult and fledgling wood storks generally disperse away from the nesting colony. Fledglings have relatively high mortality rates within the first 6 months, most likely due to their lack of experience in foraging (Hylton et al. 2006). Post-fledging survival also appears variable among years, probably reflecting the environmental variability that affects prey abundance and availability (Hylton et al. 2006). In south Florida, both adult and juvenile storks consistently disperse northward from nest sites (Kahl 1964). Storks breeding in central Florida also appear to disperse northward, but generally do not move as far (Coulter et al. 1999). Many juvenile storks from south Florida move into Georgia, Alabama, Mississippi, and South Carolina (Coulter et al. 1999; Borkhataria et al. 2004; Borkhataria et al. 2006). Some flocks of juvenile storks move well beyond the breeding range of storks (Kahl 1964).

Adult and juvenile storks return southward in the late fall and early winter months. In a study employing satellite telemetry, Borkhataria et al. (2006) reported that nearly all storks tagged in the southeast U.S. outside of Florida moved into Florida near the beginning of the dry season, including all sub-adult storks that fledged from both Florida and Georgia breeding colonies. Adult storks that bred in Georgia remained in Florida until March, and then moved back to northern breeding colonies. About 75% of all locations of tagged wood storks occurred within Florida.

Preliminary analyses of the range-wide occurrence of wood storks in December, recorded during annual Christmas bird surveys, suggest that the majority of the southeast U.S. wood stork population is in central and south Florida at this time. Relative abundance of storks in this region was 10–100 times higher than in north Florida and Georgia (Service 2007). This concentration of the range-wide population coincides with the early portion of the stork breeding season in Florida, during which prey abundance and availability are critical to breeding success. The same wetlands that support foraging for both breeding and non-breeding wood storks must also support a variety of other wading bird species (Gawlik 2002).

Foraging Habitat

Wood storks forage in a wide variety of wetland types. Wetland habitat types used include freshwater marshes, ponds, hardwood and cypress swamps, narrow tidal creeks, shallow tidal pools, and artificial wetlands such as stock ponds, seasonally flooded roadside or agricultural ditches, and managed impoundments (Coulter and Bryan 1993; Coulter et al. 1999). Optimal foraging habitats are shallow-water (depth 2–16 inches), sparsely vegetated wetlands (Ogden et al. 1978; Browder 1984; Coulter 1987; Coulter and Bryan 1993).

In south Florida, water levels in wetlands rise and peak during the wet season (June to November), and gradually recede during the dry season (December to May), which roughly corresponds with the stork nesting season. A particular location may provide suitable stork foraging depths only during part of the year. Wood storks generally use wetlands with a short hydro-period (duration of inundation) early in the nesting season, a mid-range hydro-period during the middle of the nesting season, and a long hydro-period during the latter part of the nesting season (Kahl 1964; Gawlik 2002). Browder (1984) reported that storks forage in wet prairie ponds early in the dry season, and as they dried, shifted to slough ponds later in the season.

In addition to water depth, suitable stork foraging habitats provide a sufficient density and biomass of forage fish or other prey species. Wetlands with a longer hydro-period generally support more fish and larger fish than those with a shorter hydro-period, but are too deep for stork foraging until later in the dry season (Loftus and Ecklund 1994; Jordan et al. 1997 and 1998; Turner et al. 1999). Nutrient enrichment (primarily phosphorus) has increased the density and biomass of fish in the naturally oligotrophic Everglades wetlands (Rehage and Trexler 2006). The foraging habitats associated with most wood stork colonies in south Florida encompass a wide range of hydro-period classes, nutrient conditions, and spatial configuration.

Dense submerged and emergent vegetation reduces foraging suitability by impeding stork movement through the habitat and prey detection (Coulter and Bryan 1993). Wood storks tend to select foraging areas that have an open canopy, but occasionally use sites with 50–100% canopy closure (Coulter and Bryan 1993; O'Hare and Dalrymple 1997; Coulter et al. 1999). Densely forested wetlands are seldom used for foraging (Coulter and Bryan 1993). The presence of minor to moderate amounts of submerged and emergent vegetation maintains fish populations and does not appear to preclude stork foraging.

Nesting Habitat

Wood storks build nests on live and dead shrubs or trees, as short as 3-foot mangroves and as tall as 100-foot cypress, surrounded by relatively broad expanses of open water (Palmer 1962; Rodgers et al. 1987; Ogden 1991; Coulter et al. 1999). In mixed-species nesting colonies, wood storks generally occupy the larger-diameter trees (Rodgers et al. 1996). Storks may use for many years undisturbed nesting sites that have sufficient feeding habitat in the surrounding area, but individuals do not necessarily return the same site every year (Kushlan and Frohring 1986). Storks abandon nesting sites that dry up during the nesting season (Rodgers et al. 1996). Ogden (1991) suggests that a substantial increase in stork nesting within managed or impounded wetlands in central and north Florida is a response to regional hydrologic changes that have dried natural wetland nesting sites during the spring months. Wood storks that abandon a colony early in the nesting season due to unsuitable water levels may re-nest in other nearby areas (Borkhataria et al. 2004; Crozier and Cook 2004).

Between breeding seasons or while foraging, wood storks roost in trees over dry ground, on levees, or large patches of open ground. Wood storks may also roost within wetlands while foraging far from nest sites and outside of the breeding season (Gawlik 2002). While the majority of stork nesting occurs within traditional rookeries, a handful of new stork nesting colonies are discovered each year (Meyer and Frederick 2004; Brooks and Dean 2008). New locations may represent a temporary shift of one or more historic colonies in response to changes in local conditions, or an expansion of breeding activity into new areas where habitat conditions have improved.

13.1.3 Numbers, Reproduction, and Distribution

The wood stork occurs from northern Argentina, eastern Peru and western Ecuador, north to Central America, Mexico, Cuba, Hispaniola, and the southeastern U.S. (American Ornithologists Union 1983). The Service classifies as threatened only the distinct population segment that breeds in the southeastern U.S., which is the geographic scope of this and the following section.

Wood storks formerly nested in all U.S. coastal states from Texas to South Carolina (Wayne 1910; Bent 1926; Oberholser 1938; Dusi and Dusi 1968; Oberholser and Kincaid 1974). The current breeding range includes Florida, Georgia, and South Carolina, and since 2005, North Carolina. The breeding range is expanding within these states (Service 2007). Florida and south Georgia are occupied year-round, and host storks from the remainder of the breeding range during the winter.

Our 2014 final rule that reclassified the wood stork as a threatened distinct population segment (79 FR 37077–37103) summarized available population estimates through 2013. The U.S. wood stork breeding population in the 1930s was probably between 15,000–20,000 pairs. It declined to about 10,000 pairs by 1960, and further declined to low of 2,700–5,700 pairs between 1977 and 1980 (Ogden et al. 1987). From 1984 (when the Service classified the species as endangered) to 2013, the Service and cooperators conducted 20 synoptic surveys of wood stork nesting colonies in the U.S. breeding range, of which 14 counted over 6,000 pairs, and 3 counted over 10,000 pairs (2006, 2009, and 2013). The highest count of 12,720 pairs in 2009, along with a conservative estimate of 4,000 pre-breeding age birds, suggested that U.S. wood stork population at that time was about 30,000 individuals. The average number of nesting pairs in 2013–2015 was about 10,800 (USFWS 2015, https://www.fws.gov/northflorida/WoodStorks/WOST_Data/Wood%20Stork%20Southast%20United%20States%20Nesting%20Data.html).

Annual numbers of colonies and nesting pairs are variable, but the clear trend is a gradually increasing U.S. wood stork population in a gradually expanding breeding range. The number of pairs nesting annually has roughly doubled in the past 3 decades. The number of active colonies has roughly tripled, from an average of 29 colonies before 1995 (1975–1995; range 17–54) to an average of 77 since then (1996–2013; range 44–100). Therefore, a range-wide population increase is occurring through a larger number of smaller colonies. Before 1995, average colony size was about 200 nesting pairs, and since then, has averaged about 100 pairs.

The number of chicks fledged per nesting attempt is the annual productivity measure the Service adopted for recovery monitoring purposes in the most recent revision of the wood stork recovery plan (USFWS 1997). Data collected intermittently from 1975–2013 (not in 1980 and 1986–1992) at 70 unique nesting colonies throughout the species range (average of 8.5 colonies surveyed per year; range 0–33 colonies) indicate that this measure is highly variable among sites and between years (USFWS 2013). Dividing the total number of fledglings by the total number of nests for all sites surveyed during a single year is an estimate of range-wide productivity. This annual calculation for sites surveyed 1975–2013 yields an average of 1.45 fledglings per nest (range 0.65–2.49), and a median of 1.50. A clear increasing or decreasing trend is not apparent.

These productivity data were collected irregularly, usually at a small percentage of the total number of colonies active each year (average 17%; range 0–45%). In half the years for which data are available, productivity exceeded the recovery goal of 1.5 chicks per nest attempt, and in half the years, it did not. Although variable, the observed productivity has supported population growth and range expansion. In 2014, our final rule reclassifying the wood stork as threatened (79 FR 37077–37103) stated that population trends at that time suggested the overall population could approach the delisting benchmark of 10,000 nesting pairs during the next 15–20 years.

13.1.4 Conservation Needs and Threats

The primary conservation needs of the wood stork mirror those of other species of wading birds: maintain and restore wetlands for nesting and foraging, and protect nesting sites from disturbance and predation. The principal threat to the species is habitat loss and alteration. Invasive predators and chemical contamination are potential threats. We discuss all three of these threats in the following sections.

Habitat loss and alteration

Hefner et al. (1994) estimated 55% of the 2.3 million acres of the wetlands lost in the southeastern United States between the mid-1970s and mid-1980s were located in the Gulf-Atlantic Coastal Plain, which was the historic breeding range of the wood stork. Flemming et al. (1994) attributed substantial declines in the U.S. wood stork population in the decades before the 1990s to reduced prey availability caused by wetlands loss and hydrologic alteration in south Florida, which then supported a majority of the U.S. wood stork breeding population.

Coinciding with habitat loss throughout the breeding range, the numbers of wood storks nesting within artificial impoundments and on islands created by dredging activities increased (Ogden 1991). Nesting in artificial wetlands in central and north Florida increased from about 10% of all nesting pairs in 1959–1960 to 60–82% between 1976–1986 (Ogden 1991). Ogden (1996) suggested that the increasing use of artificial wetlands indicates that wood storks are not finding suitable nesting conditions within natural wetlands or are finding better conditions within artificial wetlands. Whether reliance on artificial wetlands for nesting can sustain wood stork productivity in the long term is still unclear. Trees eventually die, and most species that tolerate extended periods of root inundation and support nesting require periods of substrate exposure to establish new seedlings.

Prey abundance and availability near nesting sites in both natural and artificial wetlands is a primary factor contributing to stork productivity. Ogden and Nesbitt (1979) attributed a decline in stork numbers to a reduced food base during a time when the number of nest sites was relatively stable. At any time, only a small fraction of all wetlands in a particular area have the water depth, prey density, and relatively open vegetative structure that support stork foraging. Browder (1978) estimated a 35% reduction in the total acreage of wetland types that support wood stork foraging south of Lake Okeechobee, Florida, for the period 1900–1973. Wetlands loss in south Florida, facilitated by local and regional networks of ditches and canals, has disproportionately affected wetlands with a short hydro-period. Typically, short hydro-period wetlands are inundated at depths that may support stork foraging only towards the end of the wet season and during the beginning of the dry season (October–January), which formerly coincided with stork nest initiation. Since the 1970s, stork nest initiation in south Florida more typically occurs in February–March, most likely in response to insufficient prey resources in shallow waters earlier in the dry season.

Kushlan and Frohring (1986) attributed a decrease in wood storks nesting on Cape Sable to the construction of drainage canals during the 1920s. Canals and associated water management infrastructure throughout south Florida have altered the seasonal depth and distribution of water in wetlands. Continuously high water levels at stork nesting sites precludes nest tree regeneration, as most species require periods of substrate exposure for seedling survival. The breeding requirements of many fishes that serve as wood stork prey are linked to seasonal and inter-annual hydrologic patterns, which water management may disrupt, causing changes in the density and spatial distribution of prey.

Non-native invasive species

The Burmese python represents a potential threat to the wood stork in south Florida. The species is well established and expanding its range in the greater Everglades ecosystem. Despite removing more than 1,400 Burmese pythons from Everglades National Park (ENP) since 2000, the estimated population is in the thousands. Burmese pythons consume a wide variety of mammal and bird species, as well as other reptiles, amphibians, and fish (Dove et al. 2011; Snow et al. 2007). In addition to a juvenile wood stork, bird species found in the digestive tracts of Burmese pythons include pied-billed grebe (*Podilymbus podiceps*), limpkin (*Aramus guarauna*), white ibis (*Eudocimus albus*), American coot (*Fulica americana*), house wren (*Troglodytes aedon),* and domestic goose (*Anser* spp.) (Dove et al. 2011). Juveniles of these giant constrictors are known to climb trees and bushes and prey upon birds. However, the amount or extent of python predation on wood storks is unknown at this time.

Chemical contamination

The risk of chemical contamination to wood stork survival and recovery is unclear. Fleming et al. (1984) reported pesticide levels high enough to cause eggshell thinning, but no effect to wood stork productivity is linked to chemical contamination. Burger et al. (1993) examined levels of heavy metals in wood storks from Florida and Costa Rica. Generally, adult birds exhibited higher levels than young birds, which is consistent with bioaccumulation from prey and various foraging locations over time. However, young birds from Florida exhibited higher levels of mercury in than young or adult birds from Costa Rica. Young birds from Florida also exhibited higher levels of cadmium and lead than young birds from Costa Rica. Burger et al. (1993) recommended monitoring lead levels in Florida, but made no conclusions about the potential health effects of contaminants to wood storks.

13.2 Environmental Baseline for Wood Stork

This section describes the current condition of the wood stork in the Action Area without the consequences to the listed species caused by the proposed Action.

13.2.1 Action Area Numbers, Reproduction, and Distribution

Figure 13-1 shows the locations of three wood stork colonies active in 2018 that are within (two colonies) or near (one colony) the Plan Area (USFWS 2019). The latter colony is within the National Audubon Society's Corkscrew Swamp Sanctuary, which is about 2 miles west of the Plan Area. In 2018, surveys reported to the USFWS counted a total of 438 pairs of wood storks at these colonies, as follows:

- 27 at the eastern-most colony near the Collier/Hendry line (the Collier-Hendry colony);
- 141 at the colony located near the southeastern corner of the Plan Area (the Barron Collier colony); and
- 270 pairs at the Corkscrew Swamp colony.

At this time, we have no productivity data for these colonies.

The HCP (section 5.2.1.2.3) cites an earlier (2017) USFWS update and map of active stork colonies that shows a fourth colony located within the Plan Area that has not been active in recent years. This former colony and the two other Plan Area colonies are within the Okaloacoochee Slough regional flowway. The Baron Collier colony is located on a shrub/brushland island within an impoundment, and the Collier-Hendry colony is located within an isolated freshwater swamp (Figure 13-2). We do not know the extent to which the Plan Area may support wood storks in the winter months that breed elsewhere.

The Corkscrew colony, monitored annually since 1958, has recorded more wood stork fledging than any other in the U.S., but total productivity has declined from a 1958–1967 average of 5,450 chicks/year to a 2009–2016 average of 287 chicks/year (National Audubon Society, https://corkscrew.audubon.org/conservation/wood-storks, accessed 8-15-2019). During the latter period, nesting occurred only in 2009 and 2014. The colony was active again in 2018. The most probable cause of the decline is a substantial loss of shallow-water wetland foraging habitats in the surrounding areas, which include the City of Naples and most of the Plan Area.

Collectively, the 18.6-mile-radius core foraging area (CFA) of the three colonies active in 2018 fully encompass the Plan Area (Figure 13-1). We lack specific data about the foraging patterns of birds that nest in the three colonies. For our analyses in this BO, we expect that the amount of wood stork foraging in the Plan Area during the breeding season is directly proportional to the fraction of foraging habitat within the Plan Area that is within each colony's CFA. That is, if 10% of the native wetlands within a CFA are within the Plan Area, we expect the Plan Area to support 10% of that colony's foraging activity. Wood storks disperse from nesting sites following the breeding season, and in south Florida colonies, this dispersal is generally to the north. Although an unknown fraction may remain in the Plan Area year-round, the primary conservation value of the Plan Area to wood storks is its contribution to productivity.

Table 13-1 tabulates the acreage of all native wetlands types inside and outside of the Plan Area for each of the three wood stork CFAs. Although non-forested wetlands more commonly support wood stork foraging, we also include forested wetlands in Table 13-1. Forested wetlands support some foraging activity, but may also provide future nesting sites as well as non-breeding season roosting sites for storks that remain for longer periods in the Plan Area. For the Corkscrew CFA, wood stork foraging habitats include estuarine types that do not occur in the Plan Area. The total wetlands acreage within the CFAs ranges from 218,530 acres (Corkscrew) to 392,133 acres (Barron Collier). The 18.6-mile radius around the Corkscrew CFA encompasses some open waters of the Gulf, which we do not include as wood stork habitat, as well as developed areas within the City of Naples, which partly accounts for its lower total wetlands acreage. The Corkscrew colony is located outside the Plan Area, but contains the highest percentage of wetlands within the Plan Area (19.6%). The Baron Collier colony contains the lowest percentage within the Plan Area (14.9%).

We lack hydro-period and other data that would allow us to estimate the relative importance of wetlands within each CFA. The prey base within the CFA of a larger colony must support the foraging needs of more storks than the CFA of a smaller colony, and the three CFAs that overlap the Plan Area substantially overlap each other. Therefore, we estimate the percentage of wood stork foraging activity for each colony that wetlands within the Plan Area are likely to support by multiplying the CFA-specific percentage of wetlands in the Plan Area by the number of storks in each colony. Table 13-1 provides this calculation under "Wood stork numbers equivalent to the 'Percentage of CFA TOTAL WETLANDS.'" By this method, we estimate that Plan Area wetlands support the total foraging needs equivalent to about 79 of the 438 wood storks (18.0%) counted at the three colonies in 2018. Although all 438 storks may at some time forage in the Plan Area, 79 storks is our estimation of the fraction that Plan Area wetlands support among the total wetlands acreage of all three CFAs.

13.2.2 Action Area Conservation Needs and Threats

Large areas of native wetlands habitat within the Plan Area have been altered via land clearing and drainage for agricultural and other land uses. This loss of habitat has likely reduced prey availability and increased competition with other wading birds. Threats to the wood stork within the Plan Area include further habitat loss and degradation. Conservation needs within the Plan

Area include the protection and management of existing suitable habitat, and the hydrologic restoration of degraded wetlands.

13.2.3 Tables and Figures

Table 13-1. Native wetlands cover (acres) within three wood stork core foraging areas (CFAs, 18.6-mile radius from nest colony site) that overlap the Plan Area, and estimated number of wood storks for which wetlands inside and outside the Plan Area would support foraging and roosting, based upon 2018 nesting colony stork counts (Percentage of CFA TOTAL WETLANDS × # storks per colony).

WOOD STORK COLONY	CFA WETLANDS INSIDE PLAN AREA	CFA WETLANDS OUTSIDE PLAN AREA	CFA TOTAL WETLANDS
Barron Collier	58,404	333,728	392,133
Collier - Hendry	57,291	251,648	308,939
Corkscrew	42,760	175,770	218,530
	Percentage of CFA TOTAL WETLANDS		
Barron Collier	14.9%	85.1%	
Collier - Hendry	18.5%	81.5%	
Corkscrew	19.6%	80.4%	
	Wood stork numbers equivalent to the "percentage of CFA TOTAL WETLANDS"		
Barron Collier (282 storks)	42	240	282
Collier - Hendry (54 storks)	10	44	54
Corkscrew (540 storks)	106	434	540
Total	158	718	876

Figure 13-1. Location of three active wood stork colonies buffered with Core Foraging Areas within and adjacent to the East Collier HCP Action Area.

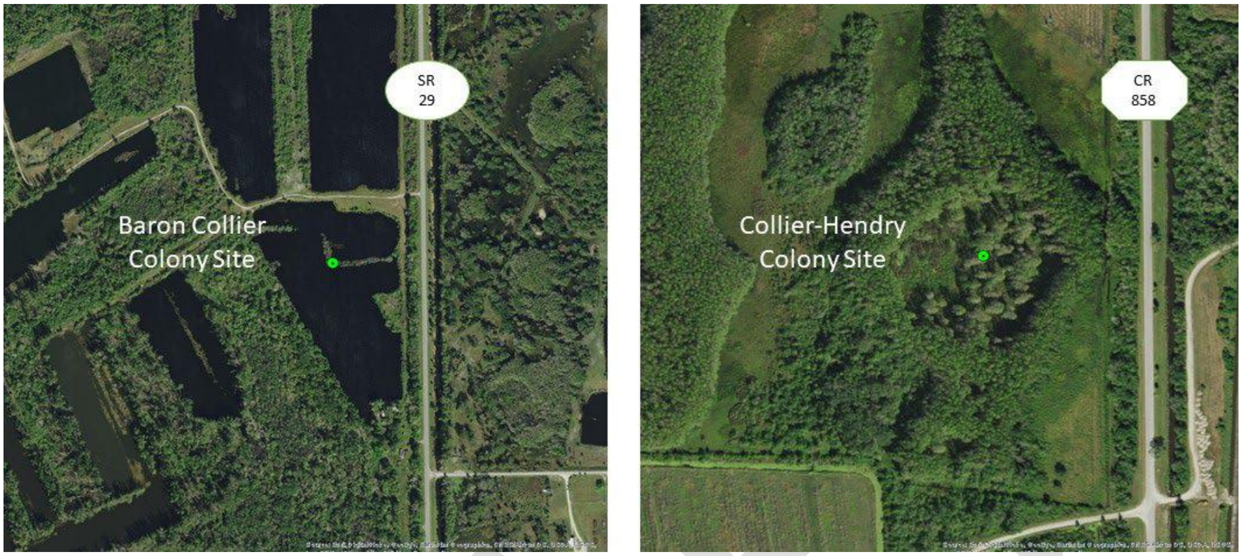


Figure 13-2. Aerial view of the immediate area around two wood stork colonies within the Plan Area that were active in 2018.

13.3 Effects of the Action on Wood Stork

This section describes all reasonably certain consequences to the wood stork that we predict the proposed Action would cause, including the consequences of other activities not included in the proposed Action that would not occur but for the proposed Action. Such effects may occur later in time and may occur outside the immediate area involved in the Action.

13.3.1 Development and Mining, Base Zoning, and Eligible Lands

Development and mining in wetlands would involve various activities (drainage, filling, excavation, paving, building construction, *etc.*) that would permanently eliminate the affected areas as wood stork habitat. The two wood stork nesting colonies active in 2018 that occur within the Plan Area (the "Barron Collier" and "Collier-Hendry" colonies; see section 13.2.1) are not within the Development and Mining, Base Zoning, and Eligible Lands designations (the potential development "envelope" of the HCP). Therefore, we do not expect development activities to directly kill or injure wood stork eggs or flightless young. However, a previously active colony that was not active in 2018 was located within a parcel of the Eligible Lands (see HCP section 5.2.1.2.3). We have no data from which to infer the cause for its recent abandonment. For this analysis, we consider the colonies active in 2018 as representative of current and expected wood stork nesting.

The core foraging areas (CFAs) of three colonies active in 2018 (the two within the Plan Area plus the Corkscrew Swamp colony) overlap areas designated as Development and Mining, Base Zoning, and Eligible Lands (Figure 13-1). Development of wetlands used as foraging areas would cause wood storks that use these areas to forage elsewhere.

Table 13-2 refines the Plan-Area-wide wetlands acreage tabulation of Table 13-1 (section 13.2.3) with a breakdown by HCP land use designation of wetlands acreage for each of the three core foraging area (CFAs) that overlap the Plan Area. For example, 2,361 acres of native wetlands within the Barron Collier colony CFA (0.6% of the CFA total wetlands acreage, 392,133 acres) are within the designated Development areas of the HCP. Further, we estimate that this percentage of the CFA wetlands, divided equally among the 282 storks nesting in this colony during 2018, would support the foraging needs equivalent to 2 of these storks (section 13.2.1 provides our rationale for this methodology). Similarly, wetlands within the Development, Base Zoning, and Eligible lands designations collectively would support the foraging needs equivalent to 6 of the Barron Collier colony storks. Table 13-2 replicates this methodology for each of the three CFAs and each of the Plan Area land use designations.

To compute the total wood stork numbers equivalent to the CFA wetland acreage within each designated land use, we sum the stork numbers associated with each CFA that overlaps the land use (the bottom row of Table 13-2). This summation recognizes that the number of storks likely to use an area is a function of the numbers of storks in all colonies with CFAs that overlap the area. By this methodology, we estimate that wetlands in the full development envelope of the HCP support the foraging needs of about 22 wood storks from the three colonies, most (16) from the Corkscrew colony. The designated Development areas support the foraging needs of about 8 wood storks.