APPENDIX 1

U.S. Fish and Wildlife Service Biological Opinion
25 February 2016
(Hillabee Expansion Project and Sabal Trail Project)

United States Department of the Interior

U. S. FISH AND WILDLIFE SERVICE

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JACKSONVILLE, FLORIDA 32256-7517

IN REPLY REFER TO:
FWS Log No. 04EF1000-2014-F-0319

February 25, 2016

James Martin
Chief, Gas Branch 3
Federal Energy Regulatory Commission
Office of Energy Projects
888 First Street, NE
Washington, DC 20426

RE: Southeast Market Pipeline- Transcontinental Gas Pipeline Company, LCC- Hillabee Expansion (Docket No. CP15-16-000) and Sabal Trail Transmission, LCC (Docket No. CP15-17-000) Projects

Dear Mr. Martin:

This letter transmits the U.S. Fish and Wildlife Service's (Service) Biological Opinion for the construction and operation of Transco's Hillabee Expansion (43.5 miles) and Sabal Trail (516.2 miles) pipeline projects and its effects on listed species per section 7 of the Endangered Species Act of 1973, as amended in 1998 (Act) (87 Stat. 884; 16 U.S.C. 1531 et seq.). These two projects are included in the Federal Energy Regulatory Commissions' (FERC) Environmental Impact Statement (EIS) for the Southeast Market Pipeline (SMP) along with the Florida Southeast Connector, which will be consulted on by the Service's South Florida Field Office. This consultation was coordinated with the field offices in Alabama, Georgia, and Florida. The request for formal consultation for the eastern indigo snake (*Drymarchon corais couperi*), Florida sand skink (*Plestiodon reynoldsi*), blue-tailed mole skink (*Eumeces egregius*), Florida scrub-jay (*Aphelocoma coerulescens*) , and longspurred mint (*Dicerandra cornutissima*) was received on October 1, 2015, with a biological assessment of the proposed action.

The Alabama Field Office (AFO) of the U.S. Fish and Wildlife Service reviewed approximately 86 miles of proposed pipeline construction for the Sabal Trail pipeline project and 44 miles of pipeline construction for the Hillabee Expansion Project. Surveys were requested for all federally listed species and recommended for all candidate and petitioned species that may be found in the project area, if suitable habitat was present. Sabal Trail Transmission, LLC provided a copy of the survey results to the AFO for the Sabal Trail Project and the AFO accepts the results of the Federal and State listed species survey report dated (Revised) June 29, 2015. The applicant's consultants, Cardno ENTRIX, provided copies of the survey results to the AFO for the Hillabee Expansion Project and the AFO accepts the results of the Federal and State listed species survey reports dated May 1, 2014, August 24, 2015, and November 6, 2015.

The Sabal Trail pipeline project consists of 516.2 miles of mainline pipeline that will begin in Alabama, cross through Georgia, and terminate in Florida. Approximately 157 miles of the new

pipeline and one compressor station would be constructed in the Georgia portion of the project. The project would occur in the nine following counties in Georgia: Stewart; Webster; Lee; Terrell; Dougherty; Mitchell; Colquitt; Brooks; and Lowndes. Approximately eighty percent of pipeline construction will occur within existing right-of-ways. Surveys were conducted for all federally and state listed species, as well as petitioned species in Georgia, in 2014 and 2015 in areas of suitable habitat along the path of the proposed project. Details on species surveyed for, survey results, protocols, and minimization efforts can be found in the EIS at www.ferc.gov using the elibrary link, docket number CP15-16. Survey results have shown one federally-listed species may be adversely affected during construction of this project, the eastern indigo snake (*Drymachon couperi*). The Jacksonville, Florida, Ecological Services Field Office is the lead Service office for this project and will be working with FERC to ensure their obligations under the Act are met concerning potential impacts to the eastern indigo snake.

The attached Biological Opinion is based on the biological assessment submitted to the Service by FERC for the Sabal Trail project. The Service determined that there would be no adverse effects to federally listed species within the Transco Hillabee Expansion project. It is our opinion that the Sabal Trail project, as described in the biological assessment, will "likely to adversely affect" the eastern indigo snake, sand skink, blue tail mole skink, Florida scrub-jay, and longspurred mint, but will not result in jeopardy of any of these species. The Service has not designated or proposed critical habitat for any of these species; therefore, our Biological Opinion does not analyze adverse modification to critical habitat.

The FERC provided a determination of "not likely to adversely affect" for the species listed in Table 1. The Service concurs with the final determination of effects for species that may occur within the action area or adjacent to the project. The following subsections detail the rationale for the determination, if surveys were conducted, and any proposed conservation measures that minimize the probability of incidental take. Because we concur with the determinations, the species located in Table 1 as "not likely to be adversely affected" will not be discussed further in the enclosed Biological Opinion.

Table 1. Affected Species (C=Candidate; E=Endangered; T=Threatened; SA=Similarity of Appearance); NLAA = "Not Likely to Adversely Affect", LAA = "Likely to Adversely Affect"

Common Name	Federal Status	Critical Habitat	Affects	Lead Service Office For Contact Info
Eastern indigo snake (*Drymarchon corais couperi*)	T		LAA	North Florida
Gopher tortoise (*Gopherus polyphemus*)	C		NLAA	North Florida
Frosted flatwoods salamander (*Ambystoma cingulate*)	T	X	NLAA	North Florida
Striped newt (*Notophthalmas perstriatus*)	C		NLAA	North Florida
Florida sand skink (*Neoseps reynoldsi*)	T		LAA	North Florida
American alligator (*Alligator mississippiensis*)	T/SA		NLAA	North Florida
Blue-tailed mole skink (*Eumeces egregius lividus*)	T		LAA	North Florida
Audubon's crested caracara (*Polyborus plancus audubonii*)	T		NLAA	North Florida
Florida scrub-jay (*Aphelocoma coerulescens*)	T		LAA	North Florida
Wood stork (*Mycteria americana*)	T		NLAA	North Florida
Florida panther (*Puma concolor coryi*)	E		NLAA	North Florida
Northern long-eared bat (*Myotis septentroinalis*)	T		NLAA	Alabama
Indiana bat (*Myotis sodalist*)	E		NLAA	Alabama
Gulf sturgeon (*Acipenser oxyrinchus desotoi*)	T	X	NLAA	North Florida
Fat three-ridge (*Amblema neislerii*)	E	X	NLAA	Georgia
Fine-lined pocketbook (*Hamiota altilis*)	T	X	NLAA	Alabama
Gulf moccasinshell (*Medionidus penicillatus*)	E	X	NLAA	Georgia
Oval pigtoe (*Pleurobema pyriforme*)	E	X	NLAA	AL/GA/FL
Purple bankclimber (*Elliptoideus sloatianus*)	T	X	NLAA	Georgia
Shinyrayed pocketbook (*Lampsilis subangulata*)	E	X	NLAA	Georgia
Southern clubshell (*Pleurobema decisum*)	E	X	NLAA	Alabama
Blue shiner (*Cyprinella caerulea*)	T		NLAA	Alabama
Longspurred mint (*Dicerandra cornutissima*)	E		LAA	North Florida

The Service appreciates the coordination and cooperation of the FERC. If you have any questions about the attached Biological Opinion, please feel free to contact Annie Dziergowski, of my staff at (904)731-3089.

Sincerely,

Jay B. Herrington
Field Supervisor

BIOLOGICAL OPINION

A Biological Opinion is a document that includes the Service's analysis of whether the proposed action, Sabal Trail Transmission, LLC pipeline project (Sabal Trail project), is likely to jeopardize the continued existence of eastern indigo snake (*Drymarchon corais couperi*), Floirda sand skink (*Plestiodon reynoldsi*), blue-tailed mole skink (*Eumeces egregius*), Florida scrub-jay (*Aphelocoma coerulescens*) , and longspurred mint (*Dicerandra cornutissima*). "To jeopardize the continued existence of a listed species" 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 the species (50 CFR §402.02). Because critical habitat has not been designated for these species, this Biological Opinion will not discuss critical habitat or analyze adverse modification.

CONSULTATION HISTORY

The biological assessment sent to the Service has a complete consultation history for the Sabal Trail project. The summary presented below highlights our early coordination and discussions about federally listed species, which is the focus of the action agency's request for Formal Consultation. The Service provided technical guidance the survey methods.

The following list is presented in reverse chronological order, starting with the most recent coordination with the Service.

2016 February 2, FERC issues Certificate Order

2016 January, The Service provided a draft biological opinion to Sabal Trail and FERC for their review.

2015 December 1, FERC sends the Service the Final EIS and BA. The EIS does include impacts to listed species and will require formal consultation on Sabal Trail with the Service.

2015 October 10, The Service provided comments to FERC regarding the DEIS.

2015 October1, FERC sends letter requesting consultation with the Service on the SMP.

2015 September 11, FERC provided the Service with the DEIS and BA for our review and comments.

2015 August 3, Consultants provide revised species reports on Sabal Trail based on 2014 and 2015 survey results to be included in the DEIS and BA.

2015 February (various dates), Consultants provide interim report for the Sand Skink Documented Habitat Analysis and follow up discussions regarding data

2014 December 23, The Service provides letter to FERC that we have no comments on the NOI for the SMP.

2014 November 21, Consultants provided updated resource reports including species surveys.

2014 September 19, The consultants for Sabal Trail sent email requesting sand skink data from the North and South Florida Field Offices regarding past consultation and research to conduct analysis of habitats where sank skinks are being detected.

2014 September 18, The Service provided letter to FERC declining our agency becoming a cooperating agency on the SMP.

2014 August/September, The applicants for all project within the SMP provided the Service a draft Migratory Bird Conservation Plan for our review and concurrence.

2014 August 19, FERC send letter to Service requesting our agency be a cooperating agency on the EIS for SMP.

2014 August 12, Meeting between North and South Florida Field Offices with Sabal Trail, Florida Southeast Connector, and their consultants to discuss temporary and permanent impacts to sand skink along the proposed pipeline project.

2014 July 3, Consultants send the Service Florida scrub-jay Habitat Evaluation and Survey results.

2014 June 15, Sabal Trail provides Service with draft resource reports, including listed species surveys, for our review.

2014 May 1, FERC conference call to discuss updates to Sabal Trail proposed pipeline project.

2014 April/May, Sabal Trail consultants emails regarding occurrence of sand skinks along the Sabal Trail proposed pipeline.

2014 February 19, The Service had a conference call with FERC and other state and federal agencies to discuss any concerns over the initial review of the proposed pipeline projects.

2014 February 18, FERC published the Notice of Intent to prepare the EIS for the SMP project with includes Sabal Trail.

2013 December 10, The Service meet with FERC to discuss the proposed pipeline project and any potential resource issues regarding federally listed species.

2013 December 4, The Service was provided a copy the initial draft resource reports that included a general project description and a species list.

2013 November 4, The Service meet with Sabal Trail and their consultants, Cardno ENTRIX, to discuss federally listed species within the proposed pipeline project.

2013 October 29, The Service received a letter from Sabal Trail initiating early review under FERCs pre-filling process.

2013 September 16, The Service was contacted and sent general information from Sabal Trail's consultants regarding the proposed pipeline project.

DESCRIPTION OF PROPOSED ACTION

Sabal Trail Transmission, LLC has filed an application with the FERC in the fall of 2014 pursuant to section 7 of the Natural Gas Act (NGA) seeking Certificates of Public Convenience and Necessity (Certificates) to construct, own, operate, and maintain interstate natural gas transmission pipelines and related facilities. The FERC is the federal agency responsible for authorizing interstate natural gas transmission facilities under the NGA, and is the lead federal agency responsible for preparing the EIS.

The Sabal Trail project would involve constructing and operating about 516.2 miles of pipeline and associated facilities (access roads, staging areas, and aboveground facilities (compressor stations), including: 481.6 miles of 36-inch-diameter Mainline pipeline in Alabama, Georgia, and Florida; 13.1 miles of 36-inch-diameter lateral pipeline (the Hunters Creek Line(HCL)) in Florida; 21.5 miles of 24-inch-diameter lateral pipeline (the Citrus County Line (CCL)) in Florida; and five new natural gas-fired compressor stations. Sabal Trail would also construct and operate the Central Florida Hub at the termination of the Mainline in Osceola County, Florida. Sabal Trail's facilities would be constructed in three phases between 2016 and 2021, with the second and third phases involving only additional compression facilities. The Sabal Trail project would provide up to 1.0 Bcf/d of firm transportation service upon completion.

Sabal Trail will use a 100-foot-wide construction right-of-way to construct the proposed Mainline route and HCL, and a 90-foot-wide construction right-of-way to construct the CCL. Additional temporary workspace outside of the 100 and 90-foot-wide construction right-of-way will also be used where additional spacing is required to safely cross infrastructure, utilities, and other sensitive environmental areas. This right-of-way would be reduced as necessary through sensitive areas such as wetlands, waterbodies, and residential lands. Constructing the Sabal Trail project would require the temporary use of about 5,984.2 acres of land. Within these sensitive areas when necessary horizontal directional drilling (HDD) will be implemented. HDD involves drilling a hole under the waterbody (or other sensitive feature) and installing a pre-fabricated pipe segment through the hole. Sabal Trail proposes to use the HDD method at 17 sensitive areas.

Sabal Trail pipeline routes will be collocated with existing rights-of-way or previously disturbed corridors for approximately 306.7 miles (59 percent) of the total pipeline length. The remaining approximately 209.5 miles (41 percent) of the pipeline route would deviate from these rights-of-ways and corridors. Of the area affected by pipeline construction, approximately 416.3 acres (7 percent) would overlap with existing easements. Following construction, Sabal Trail will retain a 50-foot-wide permanent right-of-way to operate the pipeline facilities. The permanent right-of-way would require about 2,832.3 acres of land. Of this area, about 64.6 acres would be within previously disturbed, maintained, operational easements. Routine vegetation mowing or clearing over the 50-foot-wide permanent easement in uplands will not be done more frequently than every 3 years. However to facilitate periodic corrosion/leak surveys, a corridor not exceeding 10 feet in width centered on the pipeline may be cleared at a frequency necessary to maintain the 10 foot corridor in an herbaceous state.

FERC and Sabal, in coordination with many state and federal agencies, assessed the proposed action and potential effects on listed species. The Service reviewed the project construction area and species' survey guidelines to address listed species within the action area. A total of 22 federally listed species were surveyed for to determine if Sabal Trail would impact any of these species. Sabal Trail conducted species-specific surveys for all of these species within suitable habitat of the proposed limits of construction in 2014 and again in 2015. Surveys did find the presence or assumed presence of eastern indigo snake, Florida sand skink, blue-tailed mole skink, Florida scrub-jays, and longspurred mint within the construction area.

Based on survey results, FERC has determined Sabal Trail "may affect and is likely to adversely affect" the eastern indigo snake, Florida sand skink, blue-tailed mole skink, Florida scrub-jay, and longspurred mint. The Service concurs with this determination and finds that the project will result

in adverse effects on these federally listed species and their habitats. It should also be noted that the federally listed species in Alabama and Georgia were found to be "not adversely impacted" and will not require further consultation.

Action area

The action area is defined as all areas to be directly or indirectly affected by the Federal action and not merely the immediate area involved in the action. The Service has established an action area for this project that includes all lands in Alabama, Georgia, and Florida within the pipeline project's 100-foot construction right-of-way, additional temporary workspaces, aboveground facilities (including compressor stations), staging areas, and access roads. Therefore, we conclude that the action area as described above is sufficient to capture the direct, indirect, and cumulative effects resulting from the proposed project.

Conservation Measures

Conservation measures are actions to benefit or promote the recovery of a listed species that are included by the Federal agency as an integral part of the proposed action. These actions are taken by the Federal agency or applicant and serve to avoid, minimize, or compensate for project effects on the listed species.

General Conservation Measures

- All temporary access roads and staging areas will be restored to their pre-construction conditions.
- The Applicants would separate topsoil from subsoil in residential and agricultural areas (cultivated or rotated croplands, hayfields, and managed pastures), or as requested by landowner or land managing agency. The Applicants would segregate at least the top 12 inches of topsoil where 12 or more inches of topsoil is present. In soils with less than 12 inches of topsoil, the Applicants would segregate the entire topsoil layer. During backfilling, subsoil would be returned to the trench first. Topsoil would follow such that spoil would be returned to its original horizon.
- Collocate the pipeline facilities with existing rights-of-way to minimize vegetation clearing and habitat fragmentation.
- Limit the construction and operational right-of-way widths to the minimum necessary.
- Implement the 2014 Migratory Bird Conservation Plan to minimize impacts on migratory birds.
- Install trench ramps at regular intervals to provide wildlife exits and placing gaps in the temporary trench spoil piles and pipe stringing to allow wildlife to migrate through the construction corridor.
- Implement an invasive species management plan to minimize and control the spread of noxious and invasive species.
- Restore preconstruction topography in uplands, wetlands, and waterbodies to the greatest extent practicable.
- Allow previously cleared areas where the Florida sand skink and the Florida scrub jay was documented within the 100-foot-wide construction right-of-way to revegetate naturally to eventually restore habitat characteristics, including native grasses, shrubs, and trees.

- The FERC Upland Erosion Control, Revegetation, and Maintenance Plan allows "Routine vegetation mowing or clearing over the full width of the permanent right-of-way in uplands shall not be done more frequently than every 3 years. However, to facilitate periodic corrosion/leak surveys, a corridor not exceeding 10 feet in width centered on the pipeline may be cleared at a frequency to maintain the 10-foot corridor in an herbaceous state." The FERC Wetland and Waterbody Construction and Mitigation Procedures state "Do not conduct routine vegetation mowing or clearing over the full width of the permanent right-of-way in wetlands and waterbody riparian area measured 25 feet back from the high water mark. However, to facilitate periodic corrosion/leak surveys, a corridor centered on the pipeline and up to 10 feet wide may be cleared at a frequency necessary to maintain the 10-foot corridor in an herbaceous state. In addition, trees within 15 feet of the pipeline with roots that could compromise the integrity of the pipeline coating may be selectively cut and removed from the permanent right-of-way. Do not conduct any routing vegetation mowing or clearing in wetland that are between HDD entry and exit points." Vegetation mowing or clearing will be prohibited during the bird nesting season (generally April 15 to August 1 in Alabama and Georgia, and March 1 to August 31 in Florida).

Conservation Measures for Eastern Indigo Snake

- The Applicant will implement the Standard Protection Measures for the Eastern Indigo Snake (FWS, 2013) to further minimize or avoid impacts on this species, which includes the following measures:
- Prevent the discharge of hydrostatic test water to locations where tortoise burrows are located adjacent to the construction right-of-way.
- Place informational posters identical to those recommended by the FWS at strategic locations along the project right-of-way, proposed access roads, and in construction offices.
- Conduct meetings lead by a designated agent prior to construction to educate project personnel on the informational posters and how to properly report the identification of a live, injured, or dead indigos within the right-of-way.
- Maintain and replace all posters and education materials as necessary throughout the duration of the project; and electronically submit a post construction monitoring report to the FWS within 60 days of project completion.
- If a dead, injured, or sick animal species as addressed in this Biological Opinion is found in the project area, contact the appropriate Service's Ecological Services Office.

In addition, in order to minimize incidental take of eastern indigo snakes through injury or mortality during construction, Sabal Trail proposes that certain agents be authorized to capture, handle, remove any indigo snake from the construction right-of-way and other workspaces, and immediately release them unharmed into adjacent suitable habitat. This conservation measure would most likely be employed during the excavation of gopher tortoise (*Gopherus polyphemus*) burrows (to prevent indigos from entering another burrow or other refugia in the workspace) or when an open pipeline trench is present (to remove indigos from harm's way). In the event that a clutch of eastern indigo snake eggs is discovered while searching the apron of tortoise burrows for tortoise eggs, the snake eggs would be removed without rotation, placed in moist sand, and taken to the Orianne Center for Indigo Conservation (OCIC) for incubation and captive rearing to benefit the OCIC eastern indigo snake reintroduction program. Agents authorized to temporarily handle eastern

indigo snakes and their eggs for this purpose would be limited to the following qualified personnel: Biological Monitors, FWC-approved Gopher Tortoise Authorized Agents and their designated Assistants, and Environmental Inspectors.

Conservation Measures for Florida sand skink and blue-tailed mole skink

The Service defines temporary impacts as "anywhere habitat will eventually be returned to its existing state, with soils returned to a non-compacted (swimmable) state and, the upper soil horizon (top 4"-6" where skinks may be present) replaced to the position from which it was excavate" (see Additional Skink Conservation Measures below).

- To offset temporary habitat impacts and potential injury and harm to skinks, Sabal Trail proposes to purchase credits from an approved Florida sand skink conservation bank prior to the initiation of construction in known or presumed occupied Florida sand skink habitat. It is reasonable to expect sand skink to be present in close proximity to occupied areas where surface soil, land use, and land cover are identical and there are no physical barriers to skink movement. Based on discussion with FWS staff, Sabal Trail proposes to purchase 5.1 acre-credits for the proposed temporary impacts on the 25.5 acres of occupied skink habitat (a 0.20:1 mitigation ratio).
- In native xeric habitats the applicant will clear the untrenched areas using vegetation mulching equipment such as hydroaxe (minimizing soil disturbance and allowing for the resprouting of scrub vegetation), ensuring the natural restoration of native xeric vegetation.
- The trenched area will be allowed to revegetate naturally with no planting of exotic, sod-forming grasses that may prohibit skink occupation. Because no exotic, sod-forming grasses will be planted in human-altered, occupied skink habitat, these areas should return to their former state.
- The mean generation time of Florida Sand Skinks is about four years. Thus, any injury or harm to individuals in the populations should be replaced by natural recruitment relatively quickly following construction.
- Limit the disturbance of soil to only what would be required to establish the pipeline trench, e.g. surface movement of construction equipment, clearing trench area, excavating trench and placing spoils alongside, backfilling the trench after laying pipe, and grading the trench and spoil storage areas to original contours.
- Prevent mulching and the discharge of hydrostatic test water to occupied or presumed occupied skink habitats.
- With the exception of proposed non-compacted access roads, the top 4 to 6 inches of the topsoil (A soil horizon) over the trench line within the six occupied skink sites would be removed and placed at the edge of the nonworking side of the construction right-of-way immediately adjacent to other suitable habitat (present at all six occupied sites), allowing skinks to emigrate to this habitat. The trench spoil would be stockpiled immediately adjacent to the segregated topsoil; its height should form a temporary barrier and minimize skink movement towards the trench. Following pipeline installation, the segregated soils would be returned to the trench line.
- Post-construction vegetation maintenance of the 50-foot permanent right-of-way would be limited to mowing with a rubber-tired bush-hog once every three years, if required, between the months of August and February when skinks are less active.

- Conduct post-construction pedestrian surveys for sand skink on a subsample of 25% of known, previously occupied areas (only) for Sabal Trail. A maximum of three pedestrian surveys would be conducted at least two weeks apart in the spring survey window for Florida sand skinks (March 1-May 15; USFWS 2013) until sand skinks are either observed or for up to three years following pipeline construction in the selected areas.

Conservation Measures for Florida scrub-jay

- FERC recommended in the EIS that Sabal Trail avoid construction within occupied scrub-jay habitat during the nesting season (March 1 to June 30), unless preconstruction surveys confirm that scrub-jays are not nesting within the project area during this time frame (March 1 to June 30) or Sabal Trail receives written confirmation from the Federal Energy Regulatory Commission ("Commission") that construction activities can occur within this time frame.
- In Territories 2 to 5, soil disturbance would be limited to those areas required to excavate the pipeline trench and facilities associated with pipeline protection. Pipeline markers with test leads may be placed along the portion of the pipeline that parallels existing electric transmission lines.
- Scrub vegetation would be cleared with equipment such as a hydroaxe to minimize soil disturbance and to allow the resprouting and natural recruitment of scrub vegetation. This clearing practice would also be implemented within 100 meters of territory boundary if the adjacent habitat is suitable for scrub-jays.
- Trench spoil would be temporarily stockpiled on the non-working side of the construction workspace.
- Territories would be allowed to revegetate naturally with no planting of exotic, sodforming grasses.
- Post-construction vegetation maintenance would be limited to mowing with a rubber-tired bush-hog once every three years , if required, during the months of August through February.

Conservation Measures for longspurred mint

- Sabal Trail would place safety fence along the eastern edge of the construction right-of-way to separate the 0.02 acres of longspurred mint habitat that occurs in the construction work area from the 6.29 acres of the existing longspurred mint population found within the adjacent electric transmission line corridor prior to commencing construction activities in order to reduce disturbance to the existing populations. Signs indicating an environmental sensitive area would be placed with the safety fence.
- In comments provided by the Applicant to the Draft Environmental Impact Statement, Sabal Trail noted that the area disturbed by the installation of the pipeline will provide the type of habitat preferred by the longspurred mint and will reasonably result in the expansion of the longspurred mint population in this area of the project. Thus, no other mitigative measures were necessary

STATUS OF SPECIES

Eastern Indigo Snake

In addition to the assessment below, a 5-year review was completed in 2008 resulting in no change to the species designation (Service 2008a). The 5-year review builds upon the detailed information in the MSRP for this species and is located at http://www.fws.gov/southeast/5yearReviews/5yearreviews/easternindigofinal.pdf

Species description

The eastern indigo snake is the largest non-venomous snake in North America, obtaining lengths of up to 8.5 ft (2.6 meters) (Moler 1992). Its color is uniformly lustrous-black, dorsally and ventrally, except for a red or cream-colored suffusion of the chin, throat, and sometimes the cheeks. Its scales are large and smooth (the central 3 to 5 scale rows are lightly keeled in adult males) in 17 scale rows at mid-body. Its anal plate is undivided. In the Florida Keys, adult indigo snakes seem to have less red on their faces or throats compared to most mainland specimens (Lazell 1989). Several researchers have informally suggested that Lower Keys indigo snakes may differ from mainland snakes in ways other than color. Critical habitat has not been designated for this species.

Life history

In south-central Florida, limited information on the reproductive cycle suggests that eastern indigo snake breeding extends from June to January, egg laying occurs from April to July, and hatching occurs from mid-summer to early fall (Layne and Steiner 1996). Young hatch approximately 3 months after egg-laying and there is no evidence of parental care. Eastern indigo snakes in captivity take 3 to 4 years to reach sexual maturity (Speake et al. 1987). Female eastern indigo snakes can store sperm and delay fertilization of eggs. There is a single record of a captive eastern indigo snake laying five eggs (at least one of which was fertile) after being isolated for more than 4 years (Carson 1945). However, there have been several recent reports of parthogenetic reproduction by virginal snakes. Hence, sperm storage may not have been involved in Carson's (1945) example (Moler 1998). There is no information on the eastern indigo snake lifespan in the wild, although one captive individual lived 25 years, 11 months (Shaw 1959).

Eastern indigo snakes are active and spend a great deal of time foraging and searching for mates. They are one of the few snake species that are active during the day and rest at night. The eastern indigo snake is a generalized predator and will eat any vertebrate small enough to be overpowered. They swallow their prey alive. Food items include fish, frogs, toads, snakes (venomous, as well as non-venomous), lizards, turtles, turtle eggs, small alligators, birds, and small mammals (Keegan 1944; Babis 1949; Kochman 1978; Steiner et al. 1983).

Population dynamics

Eastern indigo snakes need a mosaic of habitats to complete their annual life cycle. Over most of its range, the eastern indigo snake frequents several habitat types, including pine flatwoods, scrubby flatwoods, high pine, dry prairie, tropical hardwood hammocks, edges of freshwater marshes, agricultural fields, coastal dunes, and human-altered habitats. Eastern indigo snakes also use some agricultural lands (such as citrus) and various types of wetlands (Service 1999). A study in southern Georgia found that interspersion of tortoise-inhabited sandhills and wetlands improve habitat

quality for the eastern indigo snake (Landers and Speake 1980; Service 2004b). Eastern indigo snakes shelter in gopher tortoise burrows, hollowed root channels, hollow logs, or the burrows of rodents, armadillos, or land crabs (Lawler 1977; Moler 1985a; Layne and Steiner 1996). Throughout peninsular Florida, this species may be found in all terrestrial habitats which have not experienced high density urban development. They are especially common in the hydric hammocks throughout this region (Service 1999). In central and coastal Florida, eastern indigo snakes are mainly found within many of the State's high, sandy ridges. In extreme south Florida (*i.e.*, the Everglades and Florida Keys), eastern indigo snakes are found in tropical hardwood hammocks, pine rocklands, freshwater marshes, abandoned agricultural land, coastal prairie, mangrove swamps, and human-altered habitats (Steiner et al. 1983; Service 1999). Underground refugia used by this species include natural ground holes; hollows at the base of trees or shrubs; ground litter; trash piles; and in the crevices of rock-lined ditch walls (Layne and Steiner 1996). It is thought that they prefer hammocks and pine forests since most observations occur there and use of these areas is disproportionate compared to the relatively small total area of these habitats (Steiner et al. 1983). Observations over the last 50 years made by maintenance workers in citrus groves in east-central Florida indicate that eastern indigo snakes are occasionally observed on the ground in the tree rows and more frequently near the canals, roads, and wet ditches (Zeigler 2006). In the sugar cane fields at the A-1 Reservoir Project site in the Everglades Agriculture Area, eastern indigo snakes have been observed (including one mortality) during earthmoving and other construction-related activities.

Eastern indigo snakes range over large areas and use various habitats throughout the year, with most activity occurring in the summer and fall (Smith 1987; Moler 1985a). Adult males have larger home ranges than adult females and juveniles; their ranges average 554 acres, decreasing to 390 acres in the summer (Moler 1985b). In contrast, a gravid female may use from 3.5 to 106 acres (Smith 1987). In Florida, home ranges for females and males range from 5 to 371 acres and 4 to 805 acres, respectively (Smith 2003). At ABS, average home range size for females was determined to be 47 acres and overlapping male home ranges to be 185 acres (Layne and Steiner 1996).

Status and distribution

The eastern indigo snake was listed as threatened on January 31, 1978, (43 FR 4028), due to population declines caused by habitat loss, over-collecting for the domestic and international pet trade, and mortality caused by rattlesnake collectors who gas gopher tortoise burrows to collect snakes. The indigo snake (*Drymarchon corais*) ranges from the southeastern United States to northern Argentina (Conant and Collins 1998). This species has eight recognized subspecies, two of which occur in the United States: the eastern indigo and the Texas indigo (*D. c. erebennus*). In the United States, the eastern indigo snake historically occurred throughout Florida and in the coastal plain of Georgia and has been recorded in Alabama and Mississippi (Diemer and Speake 1983; Moler 1985b). It may have occurred in southern South Carolina, but its occurrence there cannot be confirmed. Georgia and Florida currently support the remaining endemic populations of the eastern indigo snake (Lawler 1977). The eastern indigo snake occurs throughout most of Florida and is absent only from the Dry Tortugas and Marquesas Keys, and regions of north Florida where cold temperatures and deeper clay soils exist (Cox and Kautz 2000).

Effective law enforcement has reduced pressure on the species from the pet trade. However, because of its relatively large home range, the eastern indigo snake is vulnerable to habitat loss, degradation, and fragmentation (Lawler 1977; Moler 1985a). The primary threat to the eastern

indigo snake is habitat loss due to development and fragmentation. In the interface areas between urban and native habitats, residential housing is also a threat because it increases the likelihood of snakes being killed by property owners and domestic pets. Extensive tracts of undeveloped land are important for maintaining eastern indigo snakes. In citrus groves, eastern indigo snake mortality occurs from vehicular traffic and management techniques such as pesticide usage, lawn mowers, and heavy equipment usage (Zeigler 2006). Within the 2000 to 2005 timeframe, since the spread of citrus canker, Zeigler (2006) reported seeing at least 12 dead eastern indigo snakes that were killed by heavy equipment operators in the act of clearing infected trees.

To protect and manage this species for recovery, Breininger et al. (2004) concluded that the greatest eastern indigo snake conservation benefit would be accrued by conserving snake populations in the largest upland systems that connect to other large reserves while keeping edge to area ratios low. Management of these lands should be directed towards maintaining and enhancing the diversity of plant and animal assemblages within these properties. Where these goals are achieved, eastern indigo snakes will directly benefit because of improved habitat conditions. Land managers should be encouraged to utilize fire as a tool to maintain biodiversity in fire-dependent ecosystems.

Sand Skinks

The most recent status review of the sand skink is in the 5-year review for this species (Service 2007 c). The Multi-Species Recovery Plan (Service 1999) is incorporated by reference and can be used to obtain more detailed information about this species.

Sand Skinks were listed as threatened under the Act in 1987 (52 FR 42658). A primary consideration for the listing of the species was the modification and destruction of xeric upland communities in central Florida. By some estimates, as much as 90 percent of the scrub ecosystem has already been lost to residential development and the conversion to agriculture, primarily citrus groves (Kautz 1993; Turner et al. 2006).

Species Description

The sand skink is a small, fossorial lizard that reaches a maximum length of about 5 inches. The tail makes up about half the total body length. The body is shiny and usually gray to grayish-white in color, although the body color may occasionally be light tan. Hatchlings have a wide black band located along each side from the tip of the tail to the snout. This band is reduced in adults and may only occur from the eye to snout on some individuals (Telford 1959). Sand skinks contain a variety of morphological adaptations for a fossorial lifestyle. The legs are vestigial and practically nonfunctional; the eyes are greatly reduced, the external ear openings are reduced or absent (Greer 2002), the snout is wedge-shaped, and the lower jaw is countersunk.

The taxonomic classification of the sand skink has been reevaluated since it was listed as *Neoseps reynoldsi* in 1987 (52 FR 42658), and the commonly accepted scientific name for the sand skink is now *Plestiodon reynoldsi* (Brandley et al. 2005; Smith 2005). A detailed description of the recent taxonomic review can be found in Service (2007c). The Service continues to use the scientific name as published in the final listing rule (52 FR 42658).

Genetics and Evolutionary History

The sand skink evolved and radiated on the central Lake Wales Ridge (Branch et al. 2003). Analysis of mitochondrial DNA indicates populations of the sand skink are highly structured with most of the genetic variation partitioned among four lineages: three subpopulations on the Lake Wales Ridge characterized by high haplotype diversity and a single, unique haplotype detected only on the Mount Dora Ridge (Branch et al. 2003). Under the conventional molecular clock, the 4.5 percent divergence in sand skinks from these two ridges would represent about a 2-million year separation. The absence of haplotype diversity on the Mount Dora Ridge would suggest this population was founded by only a few individuals or severely reduced by genetic drift of a small population (Branch et al. 2003).

Distribution, Habitat, and Abundance

The sand skink occurs on the sandy ridges of interior central Florida from Marion County south to Highlands County. The extant range of the sand skink includes Highlands, Lake, Marion, Orange, Osceola, Polk, and Putnam Counties (Christman 1988; Telford 1998). Principal populations occur on the Lake Wales Ridge and Winter Haven Ridges in Highlands, Lake, and Polk Counties (Christman 1992a; Mushinsky and McCoy 1991). One of largest of these ridges, the Lake Wales Ridge, located in southern Florida, encompasses approximately 517,303 acres (Weekley et al. 2008). The sand skink was once thought to be uncommon on the Mount Dora Ridge, with sites documented within the Ocala National Forest (Christman 1970; 1992a). However, recent surveys associated with Sabal Trails are documenting sand skinks in various locations on the Mount Dora Ridge (Cardn ENTRIX 2015).

The sand skink is widespread in native xeric uplands with excessively well-drained soils (Service 2012), principally on the ridges listed above at elevations greater than 82 feet above mean sea level. Commonly occupied native habitats include Florida scrub, including sand pine scrub, xeric oak scrub, rosemary scrub and scrubby flatwoods, as well as high pine communities that include sandhill, longleaf pine/turkey oak, turkey oak barrens and xeric hammock (see habitat descriptions in Myers 1990 and Service 1999). Coverboard transects extended from scrub or high pine (sandhill) through scrubby flatwoods to pine flatwoods revealed that sand skinks left more tracks in scrub than the other three habitats and did not penetrate further than 130 feet into scrubby flatwoods or 65 feet into pine flatwoods (Sutton et al. 1999).

Various authors have attempted to characterize optimal sand skink habitat (Telford 1959; 1962; Christman 1978a; 1992a; Campbell and Christman 1982). Literature descriptions of scrub characteristics have not proven very useful to predict sand skink abundance, but expert opinion was more successful (McCoy et al. 1999). McCoy et al. (1999) used trap-out enclosures to measure sand skink densities at seven scrub sites and attempted to rank each area individually based on eight visual characteristics to identify good habitat: (1) root-free, (2) grass-free, (3) patchy bare areas, (4) bare areas with lichens, (5) bare areas with litter, (6) scattered scrubs, (7) open canopy, and (8) sunny exposure. None of the individual literature descriptions of optimal habitat (or any combination thereof) accurately predicted the rank order of actual sand skink abundance at these sites, which ranged in density from 52 to 270 individuals per acre (Sutton 1996). However, knowledgeable researchers, especially as a group, appear to be able to visually sort out the environmental variables important to sand skinks, but had difficulty translating their perceptions into a set of rules that others could use to identify optimal sand skink habitat (McCoy et al. 1999).

Multiple studies (Collazos 1998; Hill 1999; Mushinsky and McCoy 1999; Gianopulos 2001; Mushinsky et al. 2001) have determined the relationship between sand skink density and a suite of environmental variables. These studies have found that sand skink relative density was positively correlated with low canopy cover, percent bare ground, amount of loose sand and large sand particle size, but negatively correlated with understory vegetation height, litter cover, small sand particle size, soil moisture, soil temperature, and soil composition. In an unburned sandhill site at Archbold Biological Station, Meshaka and Lane (2002) captured significantly more sand skinks in pitfall traps set in openings without shrubs than at sites with moderate to heavy shrub density. Telford (1959) suggested scattered debris and litter provided moisture that was important to support an abundant food supply and nesting sites for sand skinks. Cooper (1953) noted the species was most commonly collected under rotting logs, and Christman (1992b) suggested they nest in these locations. Christman (2005) found that skinks continue to occupy scrub with a closed canopy and thick humus layer, although at lower densities. Recent surveys have also shown sand skinks may occupy both actively managed lands, such as citrus groves and pine plantations, and old-field communities (Pike et al. 2007), if these sites are adjacent to patches of native habitat that can serve as a source population for recolonization.

Experimental studies have been conducted to investigate the effects of management techniques, such as mechanical treatment and prescribed burning, on sand skink abundance. Several studies found a decrease in relative abundance of skinks immediately following both mechanical and burning treatments (Mushinsky and McCoy 1999; Gianopulos 2001; Gianopulos et al. 2001; Mushinsky et al. 2001; Sutton et al. 1999). Gianopulos (2001) and Gianopulos et al. (2001) reported a significant increase in skink captures in mechanical treatment plots over the 5-year period following the treatment. However, a clear increase in skink numbers following a burn was not observed (Navratil 1999; Gianopulos et al. 2001; Mushinsky et al. 2001).

For prescribed fire, Christman (2005) conducted trap surveys at sites with a known burn history on the Lake Wales Ridge in Polk and Highlands Counties and did not observe a strong correlation between skink density and number of years since the site was burned. Mushinsky et al. (2001) noted that significantly larger skinks were captured in burned plots, indicating that more insect prey may have been available from decaying logs or that older skinks inhabited these sites. In the long-term, management techniques can influence species genetics. Recent genetic studies found that fire frequency may influence genetic diversity. The study reported that infrequent fire may be beneficial to the species, but a more frequent fire regime fire could reduce genetic diversity (Schrey et al. 2011).

Habitat size may be a factor in maintaining viable skink populations. Pike et al. (2006) monitored sand skinks and quantified vegetation change in six areas from 5 to 69 acres that were restored to a more natural state using fire and canopy thinning, and set aside for conservation in residential areas. This study documented a severe decline in occupancy and relative density of sand skinks and hypothesized that indirect impacts from surrounding development, such as changes in soil hydrology, may have caused the decline. Hydrologic changes in the soil may have occurred as a result of the construction of retention ponds or run-off from neighborhoods that caused a rise in the groundwater level (Pike et al. 2006). The population decline of skinks noted may have been caused by prescribed burning used to restore these sites (Mushinsky in Service 2007).

Life History

The sand skink is usually found below the soil surface burrowing through loose sand in search of food, shelter, and mates. Sand skinks feed on a variety of hard and soft-bodied arthropods that occur below the ground surface. The diet consists largely of beetle larvae and termites (*Prorhinotermes* spp.). Spiders, larval ant lions, lepidopteran larvae, roaches, and adult beetles are also eaten (Myers and Telford 1965; Smith 1982).

Sand skinks are most active during the morning and evening in spring and at mid-day in winter, the times when body temperatures can easily be maintained at a preferred level between 82 and 88 degrees Fahrenheit in open sand (Andrews 1994). During the hottest parts of the day, sand skinks move under shrubs to maintain their preferred body temperatures in order to remain active near the surface. With respect to season, Telford (1959) reported skinks most active from early March through early May, whereas Sutton (1996) found skinks most active from mid-February to late April. Based on monthly sampling of pitfall traps, Ashton and Telford (2006) found that captures peaked in March at Archbold Biological Station, but in May at Ocala National Forest. All of these authors suggested the spring activity peak was associated with mating. At Archbold Biological Station, Ashton and Telford (2006) noted a secondary peak in August that corresponded with the emergence of hatchling sand skinks.

Telford (1959) assumed that sand skinks become sexually mature during the first year following hatching, at a size of 1.78 inches snout-vent length. He suspected that most of the breeders in his study were in their second year and measured between 1.78 and 2.24 inches snout-vent length. However, Ashton (2005) determined that sand skinks become sexually mature between 19 and 23 months of age and have a single mating period each year from February through May. Sand skinks first reproduce at two years of age, and females produce a single clutch in a season, although some individuals reproduce biennially or less frequently (Ashton 2005). Sand skinks lay 2 to 4 eggs under logs or debris in May or early June (Ashton 2005; Mushinsky in Service 2007a), approximately 55 days after mating (Telford 1959). The eggs hatch from June through July. Sand skinks can live at least to 10 years of age (Meneken et al. 2005). Gianopulos (2001) found that the sex ratio of sand skinks did not differ significantly from 1:1, which is consistent with the findings of Sutton (1996).

Most sand skinks moved a median distance of 84 ft between captures, with a few moving over 460 feet in 2 weeks (Mushinsky et al. 2001). Similarly, other studies found that skinks sampled within 82 ft of each other shared greater genetic similarity compared to those further away suggesting their limited dispersal ability may explain the relatively high degree of genetic structure within and among sand skink populations (Branch et al. 2003; Reid et al. 2004).

Analysis of blood and fecal samples obtained from 20 sand skinks in Ocala National Forest demonstrated that no blood parasites were present, and only normal protistan and helminth symbiotes were observed, with no evidence of effect on survival of individuals or the population (Telford 1998). Similarly, a species of nematode (*Parapharyngodon ocalaensis*) was collected from the intestinal tracts of 22 sand skinks (Bursey and Telford 2003). It is not known to be a threat to the species. In a subsequent paper, Telford and Bursey (2003) found three species of endoparasites in 45 sand skinks from Ocala National Forest.

Population Dynamics

The population dynamics of sand skinks within their extant ranges are not well known because the skinks' small size and secretive habits make their study difficult. Sand skinks are known to exhibit life-history traits that are also found in a number of other fossorial lizard species, such as: delayed maturity, a small clutch size of relatively large eggs, low frequency of reproduction, and a long lifespan (Ashton 2005). Such character traits may have resulted from intraspecific competition or predation.

The current status of the sand skink throughout its geographic range is unclear because recent comprehensive, rangewide surveys have not been conducted. At the time of Federal listing in 1987, Florida Natural Area Inventory (FNAI) had recorded 31 known sites for the sand skink. By 2015, the Service had approximately 285 occurrence records with an increase in occurrence reports from Marion, Lake, and Orange Counties. The incidental observation data was compiled from a variety of sources by the Service (Service 2015). This increase is largely the result of more intensive sampling of scrub habitats in recent years and does not imply this species is more widespread than initially supposed. Nonetheless, except for a few locations where intensive research has been conducted, limited information about the presence or abundance of sand skinks exists throughout the range.

In the northern portion of the range, at least three persistent populations are under federal jurisdiction in the Ocala National Forest on the Mount. Dora Ridge (Telford 1998, Service 2007a). Sand skinks have been collected for genetic analysis in both ridges (Branch et al. 2003) and population studies have been conducted at Archbold and in Ocala National Forest (Ashton and Telford 2006). Additional studies have provided presence/absence information that has been used to determine the extant range of the species (Mushinsky and McCoy 1991; Stout and Corey 1995). However, few long-term monitoring efforts have been undertaken to evaluate the population size, or population trends, of sand skinks at these sites, on remaining scrub habitat on private lands, or rangewide.

Approximately 85 percent of xeric upland communities historically used by sand skinks on the Lake Wales Ridge are estimated to have been lost due to development (Turner et al. 2006, Service 2007c). It is likely that continued residential and agricultural development of xeric upland habitat in central Florida has destroyed or degraded habitat containing sand skinks. Protection of the sand skink from further habitat loss and degradation provides the most important means of ensuring its continued existence. Of the 73 locations examined by Turner et al. (2006) on which sand skinks were reported, 39 are protected and, as of 2004, 27 were managed. Current efforts to expand the system of protected xeric upland communities on the Lake Wales Ridge, coupled with implementation of effective land management practices in both ridges, represent a likely opportunity for assuring the sand skink's survival.

It is possible that existing private and public conservation lands on the Lake Wales Ridge may provide significant suitable habitat for sand skinks. Over the last 20 years, the State of Florida has acquired xeric upland habitat through the Florida Forever program and its predecessors (Florida Department of Environmental Protection 2008). Combined, these land acquisition programs have protected almost 25,000 acres of xeric uplands (Turner et al. 2006). The Service has also acquired portions of several tracts totaling 1,800 acres as a component of the Lake Wales Ridge National Wildlife Refuge (Service 1993a).

Table 3. is a GIS desktop analysis with the acres of the FNAI protected lands within two of the ridge systems, Mount Dora and Lake Wales, that have suitable soils and elevation. Our analysis queried the Natural Resources Conservation Service soil database for well-drained, sandy soils (Apopka, Archbold, Astatula, Candler, Daytona, Duette, Kendrick, Lake, Orsino, Paola, Pomello, Satellite, St. Lucie and Tavares soils (Service 2011), and clipped out soils that occurred in elevations at 82 ft or higher. This desktop analysis is a rough estimate of potential habitat on two major ridges but has not been ground-truthed or surveyed.

NAME	Total Acres	Potential Sand Skink Habitat Acres: Elevation 82 feet and Skink Soils	Total Acres of Protected Lands within Ridge	Potential Sand Skink habitat under Protection within Ridge
Mount Dora Ridge	267,718	183,614	123,628	101,854
Lake Wales Ridge	514,522	271,253	61,148	20,718

Source: Geographic Information System (GIS) desktop analysis Service 2015.
GIS Sources: Ridges: FDEP, FNAI: Protection Lands, Soils: U.S. Department of Agriculture, Natural Resources Conservation Service, Elevation: U.S. Geological Services

Recent studies estimated the current geographic distribution and total population size of sand skinks on public and privately owned conservation lands on the Lake Wales Ridge. The study found approximately 29,513 acres of suitable habitat on conservation lands on the Lake Wales Ridge. Total population size was estimated using mean density from 55 enclosure traps and applying the mean density across the public and privately owned conservation lands. During the spring time prior to reproduction, total skink population was estimated at 2.16 million individuals (95% confidence interval = 1.72 – 2.60 million) (Mushinsky et. al 2011b). Although this estimated population assumes average density across all protected, suitable habitats in the Lake Wales Ridge, it demonstrates the amount protected and occupied sand skink habitat will assist recovery and reduce the risk of extirpation.

Because sand skinks have low dispersal abilities, introductions into restored or created unoccupied habitat in the Mount Dora or other ridges may be necessary. Sand skinks relocated to two former citrus groves in Orange County have persisted for at least 5 years (Hill 1999; Mushinsky et al. 2001). Comparisons of persistence, recruitment, and survival were used to determine translocation success of sand skinks on two restored scrub sites for 6 years following relocation (Mushinsky et al. 2001; Penney 2001; Penney et al. 2001). One site established a self-sustaining population, while the other did not. It was determined that site location, habitat suitability, and initial propagule size were the factors affecting success; researchers concluded that the chances of long-term survival may improve when habitat is restored, and skinks are introduced to sites close to intact scrub, rather than to isolated sites (Mushinsky et al. 2001; Penney 2001).

Blue-tailed Mole Skink

The following discussion is summarized from the MSRP (Service 1999) and the 5-year status review (Service 2007b), as well as from recent research publications and monitoring reports. A complete blue-tailed mole skink life history discussion may be found in the MSRP.

Species description

The mole skink (*Eumeces egregius*) is a small, fossorial lizard that occupies xeric upland habitats of Florida, Alabama, and Georgia (Mount 1963). Five subspecies have been described (Mount 1965), but only the blue-tailed mole skink (*Eumeces egregius lividus*) is federally listed. It requires open, sandy patches interspersed with sclerophyllous vegetation (Service 1999). The historic and anticipated future modification and destruction of xeric upland communities in central Florida were primary considerations in listing the blue-tailed mole skink as threatened under the Act in 1987 (52 FR 42662). No critical habitat has been designated for the blue-tailed mole skink.

Mount (1965) described the blue-tailed mole skink largely on the basis of a bright blue tail in juveniles and restricted this subspecies to the southern LWR in Polk and Highlands Counties. Christman (1978b) limited the range of blue-tailed mole skinks to these two counties, but later added Osceola County to the range, based on the collection of a single juvenile of the subspecies just north of the Polk County line on the LWR (Christman 1992a, FNAI records). Analysis of mtDNA (Branch et al. 2003) supports Mount's (1965) hypotheses that blue-tailed mole skinks from the lower LWR represent the ancestral stock with radiation from there. Genetic analysis also indicates high population structure with limited dispersal in mole skinks among sandy habitats (Branch et al. 2003).

The blue-tailed mole skink reaches a maximum length of about 5 inches, and the tail makes up about half the body length. The body is shiny, and brownish to pink in color, with lighter paired dorsolateral stripes diverging posteriorly (Christman 1978b). Males develop a colorful orange pattern on the sides of the body during breeding season. Juveniles usually have a blue tail (Christman 1992; P. Moler, FWC, personal communication 1998). Regenerated tails and the tails of older individuals are typically pinkish. The legs are somewhat reduced in size and used only for surface locomotion and not for "swimming" through the sand (Christman 1992a).

A variety of xeric upland communities provide habitat for the blue-tailed mole skink, including rosemary and oak-dominated scrub, turkey oak barrens, high pine, and xeric hammocks. Areas with few plant roots, open canopies, scattered shrub vegetation, and patches of bare, loose sand provide optimal habitats (Christman 1988, 1992a). Within these habitat types, blue-tailed mole skinks are typically found under leaves, logs, palmetto fronds, and other ground debris. Shaded areas presumably provide suitable microhabitat conditions for thermoregulation, egg incubation, and foraging (Mount 1963). Blue-tailed mole skinks tend to be clumped in distribution with variable densities that may approach 25 adults per acre (Christman 1992a). The distribution of blue-tailed mole skinks appears to be closely linked to the distribution of surface litter and, in turn, suitable microhabitat sites.

Specific physical structures of habitat that sustain sand skink populations, and likely blue-tailed mole skink populations as well, include a well-defined leaf litter layer on the ground surface and shade from either a tree canopy or a shrub layer, but not both. Leaf litter likely provides important skink foraging opportunities. Shade provided by a tree canopy or a shrub layer likely helps skinks regulate body temperature to prevent overheating. However, having both a tree canopy and a shrub layer appears to be detrimental to skinks (McCoy 2011, University of South Florida, personal communication).

Either natural fires started by lightning or prescribed burns are necessary to maintain habitat in natural scrub ecosystems. However, if fire occurs too frequently, leaf litter might not build up sufficiently to support skink populations. At ABS, sand skinks appear to be most abundant after 10 years of leaf litter development. The ideal fire frequency to maintain optimal leaf litter development for skinks likely varies by site and other environmental conditions (Mushinsky 2011, University of South Florida, personal communication).

Life history

Sand skinks and blue-tailed mole skinks generally partition rather than compete with one another for resources. Sand skinks are primarily fossorial; they move or "swim" below the surface of the ground in sandy soils and take prey below the surface. Blue-tailed mole skinks are semi-fossorial; they hunt primarily at the soil surface or at shallow depths to 2 inches and consume mostly terrestrial arthropods (Smith 1977, Service 1993a). Foraging activities usually occur during the morning or evening. Roaches, crickets, and spiders make up the bulk of the diet (Mount 1963). Their diet is more generalized than that of the fossorial sand skink, which probably reflects their tendency to feed at the surface (Smith 1982). Like sand skinks, mole skinks show an activity peak in spring (Mount 1963, Smith 1982). The reproductive biology of the blue-tailed mole skink is poorly known. Reproduction is presumably very much like that of the peninsula mole skink, *E. e. onocrepis*, where mating occurs in the fall or winter. In the peninsula mole skink, two to nine eggs are laid in a shallow nest cavity less than 12 inches below the surface. The eggs incubate for 31 to 51 days, during which time the female tends the nest. Individuals probably become reproductively active at 1 year of age (Mount 1963; Christman 1978b). No data are available on blue-tailed mole skink home ranges or dispersal.

Population dynamics

The Service has little information on the population dynamics of blue-tailed mole skinks within their extant ranges. The skinks' diminutive size and secretive habits make their study difficult. Blue-tailed mole skinks often seem absent or rare on the same LWR study sites where sand skinks are common, and when present, are patchily distributed (Christman 1988, 1992a; Mushinsky and McCoy 1995). Mount (1963) noted peninsula mole skinks also are patchily distributed and mostly occurred on xeric sites greater than 100 acres (40 ha) in size. Early maturity (1 year in laboratory) and a large clutch size (maximum = nine eggs) of relatively small eggs (Mount 1963) suggest the population dynamics of mole skinks are different from sand skinks.

Status and distribution

The historic and anticipated future modification and destruction of xeric upland communities in central Florida were primary considerations in listing the blue-tailed mole skink as threatened under the Act in 1987 (52 FR 42662). Almost 90 percent of the xeric upland communities on the LWR have already been lost because of habitat destruction and degradation due to residential development and conversion to agriculture, primarily citrus groves (Turner et al. 2006). Remaining xeric habitat on private lands is especially vulnerable because projections of future human population growth suggest additional demands for residential development within the range of the blue-tailed mole skink. Campbell and Christman (1982) characterized blue-tailed mole skinks as colonizers of a patchy, early successional, or disturbed habitat type, which occurs throughout the sandhill, sand pine scrub, and xeric hammock vegetative associations as a result of biological or catastrophic factors. Susceptibility of mature sand pine to windthrow may be an important factor in

maintaining bare, sandy microhabitats required by blue-tailed mole skinks and other scrub endemics (Myers 1990).

At the time of Federal listing, there were 20 locality records for the blue-tailed mole skink. Currently, 43 sites are known. The increase in locality records is largely the result of more intensive sampling of scrub habitats in recent years and does not imply that this species is more widespread than originally supposed. Of the known locations, only 13 occur on public land or on private land protected under conservation easement. Turner et al. (2006) suggested blue-tailed mole skinks may be under-represented in the reserve network of protected public lands, but could not determine if their absence is a result of exclusion or sampling effort. It is likely continued residential and agricultural development of xeric upland habitat in central Florida has destroyed or degraded extensive tracts of habitat containing the blue-tailed mole skink. Estimates of habitat loss range from 60 to 90 percent, depending on the xeric community type (Christman 1988; Christman and Judd 1990; Kautz 1993; Center for Plant Conservation 1995). Blue-tailed mole skinks are known to be present on sites which total 52.4 percent of the 21,597 acres (8,740 ha) of Florida scrub and high pine that is currently protected (Turner et al. 2006). However, the extent of potential habitat that is actually occupied is unknown, as is their total population size. As noted above, this species appears to be patchily distributed, even in occupied habitat (Mount 1963; Christman 1992). Unlike sand skinks, their tracks cannot be easily detected in the sand, and most of the extant scrub sites on the LWR have not been adequately surveyed for blue-tailed mole skinks, including protected sites.

A density study of blue-tailed mole and sand skinks was conducted in 2004-2005 by Christman (2005). Only two blue-tailed mole skinks were observed in the enclosures (mean density = 3.3 per ha, 1.3 per acre) relative to at least 84 sand skinks (ratio = 1:41). Christman (1992a) suggested only 1 blue-tailed mole skink is encountered for every 20 sand skinks. Other range-wide pitfall trap data on the LWR revealed a blue-tailed mole skink to sand skink ratio of 1:1.89 based on 54 total skinks captured in six trap arrays (Christman 1988), 1:4.3 based on 332 total skinks in 58 trap arrays (Mushinsky and McCoy 1991), and 1:2.7 based on 49 total skinks in 31,640 pitfall trap-days (Meshaka and Lane 2002). Mushinsky and McCoy (1991) confirmed that detection rates for blue-tailed mole skinks increased with sampling effort.

The protection and recovery of blue-tailed mole skinks will require habitat loss be stopped and unoccupied but potentially suitable habitat be restored. The existing protection of the blue-tailed mole skink includes a number of private and public preserves within the LWR. Current efforts to expand the system of protected xeric upland habitats on the LWR, in concert with implementation of aggressive land management practices, represent the most likely opportunity for securing the future of this species. Comprehensive land acquisitions that protect areas occupied by the blue-tailed mole skink include the Service's Lake Wales Ridge National Wildlife Refuge, (LWRNWR) and the State of Florida's Conservation and Recreation Lands (CARL) LWR Ecosystem Project (Service 1993a).

In summary, little information is available to adequately assess the status and population dynamics of the blue-tailed mole skink. This subspecies is endemic to central Florida and is a habitat specialist that relies on early successional xeric scrub habitat for its continuing existence. Estimates of habitat loss range from 60 to 90 percent, depending on the xeric community type (Christman 1988, Christman and Judd 1990, Kautz 1993, Center for Plant Conservation 1995). Furthermore, the implementation of favorable management practices can create and maintain suitable habitat conditions for both sand and blue-tailed mole skinks, as well as other xeric upland-dependent species. A number of actions over the last 20 years have resulted in conservation

benefits to xeric uplands within the extant range of both species. The State of Florida has acquired xeric upland habitat through the CARL, Save Our Rivers, and other P-2000 acquisition programs. Combined, these land acquisition programs have protected 10,000 acres of xeric uplands (Florida Department of Environmental Protection [FDEP] 1998; South Florida Water Management District [District] 1998). The Service has also acquired portions of several small tracts totaling 800 acres as a component of the LWRNWR. Finally, private organizations, such as TNC and ABS have bought and currently manage xeric uplands within the LWR.

Florida Scrub-jay

In addition to the assessment below, a 5-year review was completed in 2007 resulting in no change to the species designation (Service 2007a). The 5-year review builds upon the detailed information in the MSRP for this species and is located at http://www.fws.gov/southeast/5yearReviews/5yearreviews/Florida-scrub-jay.pdf

Species description

Florida scrub-jays are about 25 to 30 cm (10 to 12 inches) long and weigh about 85 grams (3 ounces). They are similar in size and shape to blue jays (*Cyanocitta cristata*), but differ significantly in coloration (Woolfenden and Fitzpatrick 1996a; Service 1990). Unlike the blue jay, the Florida 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 Florida scrub-jay's head, nape, wings, and tail are pale 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). Florida 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). Florida scrub-jays that are 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. Molting occurs between early June and late November and peaks between mid-July and late September (Bancroft and Woolfenden 1982). During late summer and early fall, when the first basic molt is nearly done, fledgling Florida scrub-jays may be indistinguishable from adults in the field (Woolfenden and Fitzpatrick 1984). The wide variety of vocalizations of Florida scrub-jays is described in Woolfenden and Fitzpatrick (1996b).

Scrub-jays are in the order Passeriformes and the family Corvidae. They have been called a "superspecies complex" and described in four groups that differ in geographic distribution within the United States and Mexico: *Aphelocoma californica*, from southwestern Washington through Baja California; *A. insularis*, on Santa Cruz in the Channel Islands, California; *A. woodhousii*, from southeastern Oregon and the Rocky Mountains and Great Plains to Oaxaca, Mexico; and *A. coerulescens* in peninsular Florida (American Ornithologists' Union [AOU] 1983). Other jays of the same genus include the Mexican jay or gray-breasted jay (*A. ultramarina*) and the unicolored jay (*A. unicolor*) of Central America and southwest North America (Woolfenden and Fitzpatrick 1996b).

The Florida scrub-jay, which was originally named *Corvus coerulescens* by Bosc in 1795, was transferred to the genus *Aphelocoma* in 1851 by Cabanis. In 1858, Baird made *coerulescens* the type species for the genus, and it has been considered a subspecies (*A. c. coerulescens*) for the past several decades (AOU 1957). It recently regained recognition as a full species (Florida scrub-jay,

Aphelocoma coerulescens) from the AOU (AOU 1995) because of genetic, morphological, and behavioral differences from other members of this group: the western scrub-jay (*A. californica*) and the island scrub-jay (*A. insularis*). This species account references the full species name, *A. coerulescens*, as listed in the Federal Register (Service 1987a). The group name is retained for species in this complex; however, it is now hyphenated to "scrub-jay" (AOU 1995). Critical habitat has not been designated for the Florida scrub-jay.

Life history

The Florida scrub-jay has specific habitat needs. It 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 Florida scrub-jay. This community type is adapted to nutrient-poor soils, periodic drought, and frequent fires (Abrahamson 1984a and 1984b). Xeric oak scrub on the Lake Wales Ridge (LWR) is predominantly made up of four species of stunted, low-growing oaks: sand live oak (*Quercus geminata*), Chapman oak (*Q. chapmanii*), myrtle oak (*Q. myrtifolia*), and scrub oak (*Q. inopina*) (Myers 1990). In optimal habitat for Florida scrub-jays on the LWR, these oaks are 1 to 3 meters (3 to 10 ft) high, interspersed with 10 to 50 percent unvegetated, sandy openings, and a sand pine (*Pinus clausa*) canopy of less than 20 percent (Woolfenden and Fitzpatrick 1991). Other trees and dense herbaceous vegetation is rare. Vegetation noted along with the oaks includes saw palmetto (*Serenoa repens*) and scrub palmetto (*Sabal etonia*), as well as woody shrubs such as Florida rosemary (*Ceratiola ericoides*) and rusty lyonia (*Lyonia ferruginea*).

Florida scrub-jays occupy areas with less scrub oak cover and fewer openings on the Merritt Island/Cape Canaveral Complex and in southwest Florida than typical of xeric oak scrub habitat on the LWR (Schmalzer and Hinkle 1992; Breininger et al. 1995; Thaxton and Hingtgen 1996). The predominant communities here are oak scrub and scrubby flatwoods. Scrubby flatwoods differ from scrub by having a sparse canopy of slash pine (*Pinus elliotii*); sand pines are rare. Shrub species mentioned above are common, except for scrub oak and scrub palmetto, which are restricted to the LWR. Runner oak (*Q. minima*), turkey oak (*Q. laevis*), bluejack oak (*Q. incana*), and longleaf pine (*Pinus palustris*) also have been reported. Kennedy Space Center, in Brevard County, supports one of the largest contiguous populations of Florida scrub-jays. Studies conducted there give good descriptions of this habitat type (Schmalzer and Hinkle 1992).

Optimal Florida scrub-jay habitat occurs as patches with the following attributes: (1) 10 to 50 percent of the oak scrub made up of bare sand or sparse herbaceous vegetation; (2) greater than 50 percent of the shrub layer made up of scrub oaks; (3) a mosaic of oak scrubs that occur in optimal height (1 to 3 meters) and shorter; (4) less than 15 percent canopy cover; and (5) greater than 300 meters (984 feet) from a forest (Breininger et al. 1998). Much potential Florida 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). These native matrix habitats supply prey for Florida scrub-jays and habitat for other species of conservation concern. The flammability of native matrix habitats is important for spreading fires into oak scrub (Breininger et al. 1995, Breininger et al. 2002). Degradation or replacement of native matrix habitats with habitat fragments and industrial areas attract predators of Florida scrub-jays, such as fish crows (*Corvus ossifragus*), that are rare in most regularly burned native matrix habitats (Breininger and Schmalzer 1990; Woolfenden and Fitzpatrick 1991). Matrix habitats often develop into woodlands and forests when there is a disruption of fire regimes. These woodlands and forests

are not suitable for Florida scrub-jays, decrease the habitat suitability of nearby scrub, attract predators, and further disrupt fire patterns.

Florida scrub-jays have a social structure that involves cooperative breeding, a trait that the other North American species of scrub-jays do not show (Woolfenden and Fitzpatrick 1984; Woolfenden and Fitzpatrick 1990). Florida 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 Florida scrub-jays stay with the breeding pair in their natal territory as "helpers," forming a closely-knit, cooperative family group. Pre-breeding numbers are generally reduced to either a pair with no helpers or families of three or four individuals (a pair plus one or two helpers) (Woolfenden and Fitzpatrick 1996a).

Florida scrub-jays have a well-developed intrafamilial dominance hierarchy with breeder males most dominant, followed by helper males, breeder females, and, finally, female helpers (Woolfenden and Fitzpatrick 1977; Woolfenden and Fitzpatrick 1984). Helpers take part in sentinel duties (Woolfenden and Fitzpatrick 1984; McGowan and Woolfenden 1989), territorial defense (Woolfenden and Fitzpatrick 1984), predator-mobbing, and the feeding of both nestlings (Stallcup and Woolfenden 1978) and fledglings (Woolfenden and Fitzpatrick 1984; McGowan and Woolfenden 1990). The well-developed sentinel system involves having one individual occupying an exposed perch watching for predators or territory intruders. When a predator is seen, the sentinel Florida scrub-jay gives a distinctive warning call (McGowan and Woolfenden 1989; McGowan and Woolfenden 1990), and all family members seek cover in dense shrub vegetation (Fitzpatrick et al. 1991).

Florida scrub-jay pairs occupy year-round, multipurpose territories (Woolfenden and Fitzpatrick 1978; Woolfenden and Fitzpatrick 1984; Fitzpatrick et al. 1991). Territory size averages 22 to 25 acres (Woolfenden and Fitzpatrick 1990; Fitzpatrick et al. 1991), with a minimum size of about 12 acres (Woolfenden and Fitzpatrick 1984; Fitzpatrick et al. 1991). The availability of territories is a limiting factor for Florida scrub-jay populations (Woolfenden and Fitzpatrick 1984). Because of this limitation, nonbreeding adult males may stay at the natal territory as helpers for up to 6 years, waiting for either a mate or territory to become available (Woolfenden and Fitzpatrick 1984). Florida scrub-jays may become breeders in several ways: (1) by replacing a lost breeder on a non-natal territory (Woolfenden and Fitzpatrick 1984); (2) through "territorial budding," where a helper male becomes a breeder in a segment of its natal territory (Woolfenden and Fitzpatrick 1978); (3) by inheriting a natal territory following the death of a breeder; (4) by establishing a new territory between existing territories (Woolfenden and Fitzpatrick 1984); or (5) through "adoption" of an unrelated helper by a neighboring family followed by resident mate replacement (Woolfenden and Fitzpatrick 1984). Territories also can be created by restoring habitat through effective habitat management efforts in areas that are overgrown (Thaxton and Hingtgen 1994).

To become a breeder, a Florida scrub-jay must find a territory and a mate. Evidence presented by Woolfenden and Fitzpatrick (1984) suggests that Florida scrub-jays are monogamous. The pair retains ownership and sole breeding privileges in its particular territory year after year. Courtship to form the pair is lengthy and ritualized and involves posturing and vocalizations made by the male to the female (Woolfenden and Fitzpatrick 1996b). Copulation between the pair is generally out of sight of other Florida scrub-jays (Woolfenden and Fitzpatrick 1984). These authors also reported never observing copulation between unpaired scrub-jays or courtship behavior between a female and a scrub-jay other than her mate. Age at first breeding in the scrub-jay varies from 1 to 7 years,

although most individuals become breeders between 2 and 4 years of age (Fitzpatrick and Woolfenden 1988). Persistent breeding populations of Florida 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).

Florida scrub-jay nests are typically constructed in shrubby oaks, at a height of 1 to 2 meters (1.6 to 8.2 ft) (Woolfenden 1974). Sand live oak and scrub oak are the preferred shrubs on the LWR (Woolfenden and Fitzpatrick 1996b), and myrtle oak is favored on the Atlantic Coastal Ridge (Toland 1991) and southern Gulf coast. In suburban areas, Florida scrub-jays nest in the same evergreen oak species as well as in introduced or exotic trees; however, they build their nests in a significantly higher position in these oaks than when in natural scrub habitat (Bowman et al. 1996). Florida scrub-jay nests are an open cup, about 7 to 8 inches outside diameter and 3 to 4 inches inside diameter. The outer basket is bulky and built of course twigs from oaks and other vegetation, and the inside is lined with tightly wound palmetto or cabbage palm (*Sabal palmetto*) fibers. There is no foreign material as may be present in a blue jay nest (Woolfenden and Fitzpatrick 1996b).

Nesting is synchronous, normally occurring from 1 March through 30 June (Woolfenden and Fitzpatrick 1984). On the Atlantic Coastal Ridge and southern Gulf coast, nesting may be protracted through the end of July. In suburban habitats, nesting is consistently started earlier (March) than in natural scrub habitat (Fleischer 1996), although the reason for this is unknown.

Clutch size ranges from one to five eggs, but is typically three or four eggs (Woolfenden and Fitzpatrick 1990). Clutch size is generally larger in suburban habitats, and the birds try to rear more broods per year (Fleischer 1996). Double brooding by as much as 20 percent has been documented on the Atlantic Coastal Ridge and in suburban habitat within the southern Gulf coast, compared to about 2 percent on the LWR. Florida scrub-jay eggs measure 1.1 x 0.8 inches (length x breadth) (Woolfenden and Fitzpatrick 1996b), and coloration "varies from pea green to pale glaucous green… blotched and spotted with irregularly shaped markings of cinnamon rufous and vinaceous cinnamon, these being generally heaviest about the larger end" (Bendire 1895). Eggs are incubated for 17 to 19 days (Woolfenden 1974), and fledging occurs 15 to 21 days after hatching (Woolfenden 1978). Only the breeding female incubates and broods eggs and nestlings (Woolfenden and Fitzpatrick 1984). Average production of young is two fledglings per pair, per year (Woolfenden and Fitzpatrick 1990; Fitzpatrick et al. 1991), and the presence of helpers improves fledging success (Woolfenden and Fitzpatrick 1990; Mumme 1992). Annual productivity must average at least two young fledged per pair for a population of Florida scrub-jays to support long-term stability (Fitzpatrick et al. 1991).

Fledglings depend upon adults for food for about 10 weeks, during which time they are fed by both breeders and helpers (Woolfenden 1975; McGowan and Woolfenden 1990). Survival of Florida scrub-jay fledglings to yearling age class averages about 35 percent in optimal scrub, while annual survival of both adult males and females averages around 80 percent (Woolfenden and Fitzpatrick 1996b). Data from Archbold Biological Station (ABS), however, suggest survival and reproductive success of Florida scrub-jays in suboptimal habitat is lower (Woolfenden and Fitzpatrick 1991). These data help explain why local populations inhabiting unburned, late successional habitats become extirpated. Similarly, data from Indian River County show mean annual productivity declines significantly in suburban areas where Toland (1991) reported productivity averaged 2.2 young fledged per pair in contiguous optimal scrub, 1.8 young fledged per pair in fragmented

moderately-developed scrub, and 1.2 young per pair fledged in very fragmented suboptimal scrub. The longest observed lifespan of a Florida scrub-jay is 15.5 years at ABS in Highlands County (Woolfenden and Fitzpatrick 1996b).

Florida scrub-jays are nonmigratory and permanently territorial. Juveniles stay in their natal territory for up to 6 years before dispersing to become breeders (Woolfenden and Fitzpatrick 1984; Woolfenden and Fitzpatrick 1986). Once Florida 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 percent of Florida scrub-jays disperse more than 5 miles (Stith et al. 1996). All documented long-distance dispersals have been in unsuitable habitat such as woodland, pasture, or suburban plantations. Florida scrub-jay dispersal behavior is affected by the intervening land uses. Protected scrub habitats will most effectively sustain Florida scrub-jay populations if they are located within surrounding habitat types that can be used and traversed by Florida 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. Stith et al. (1996) believe a dispersal distance of 5 miles is close to the biological maximum for Florida scrub-jays.

Florida 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, particularly orthopterans (*e.g.*, locusts, crickets, grasshoppers, beetles) and lepidopteran (*e.g.*, butterfly and moth) larvae, form most of the animal diet throughout most of the year (Woolfenden and Fitzpatrick 1984). Small vertebrates are eaten when encountered, including frogs and toads (*Hyla femoralis*, *H. squirella,* rarely *Bufo quercicus,* and unidentified tadpoles, lizards (*Anolis carolinensis*, *Chemidophorus sexlineatus*, *Sceloporus woodi*, *Eumeces inexpectatus*, *Neoseps reynoldsi*, *Ophisaurus compressus*, *O. ventralis*), small snakes (*Thamnophus sauritus*, *Opheodrys aestivus*, *Diadophis punctatus*), small rodents (cotton rat [*Sigmodon hispidus*], *Peromyscus polionotus*, black rat [*Rattus rattus*] young), downy chicks of the bobwhite (*Colinus virginianus*), and fledgling common yellowthroat (*Geothlypis trichas*). In suburban areas, Florida scrub-jays will accept supplemental foods once the scrub-jays have learned about them (Woolfenden and Fitzpatrick 1984).

Acorns are the principal plant food (Woolfenden and Fitzpatrick 1984; Fitzpatrick et al. 1991). From August to November each year, Florida scrub-jays may harvest and cache 6,500 to 8,000 oak (*Quercus* spp.) 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). On the Atlantic Coastal Ridge, acorns are often cached in pine trees, either in forks of branches, in distal pine boughs, under bark, or on epiphytic plants, between 1 to 30 ft in height. Other small nuts, fruits, and seeds also are eaten (Woolfenden and Fitzpatrick 1984).

Many Florida scrub-jays occur in habitat conditions where their long-term persistence is doubtful, although their persistence in these areas can occur for many years (Swain et al. 1995; Stith et al. 1996; Root 1998; Breininger et al. 2002). A primary cause for Florida 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). The reduction in fire frequency is associated with increases in shrub height, decreases in

open space, increases in tree densities, and the replacement of scrub and marshes by forests (Duncan and Breininger 1998; Schmalzer and Boyle 1998; Duncan et al. 1999). These habitat trajectories result in declines in habitat use and demographic success (Woolfenden and Fitzpatrick 1984; Woolfenden and Fitzpatrick 1991). As a result, mean family size declines, and eventually the number of breeding pairs can decline by 50 percent every 5 to 10 years (Woolfenden and Fitzpatrick 1991; Breininger et al. 1999; Breininger et al. 2002).

Population dynamics

Stith (1999) utilized a spatially explicit individual-based population model developed specifically for the Florida scrub-jay to complete a metapopulation viability analysis of the species. The species' range was divided into 21 metapopulations demographically isolated from each other. Metapopulations are defined as collections of relatively discrete demographic populations distributed over the landscape; these populations are connected within the metapopulations through dispersal or migration (Hanski and Gilpin 1991). A series of simulations were run for each of the 21 metapopulations based on different scenarios of reserve design ranging from the minimal configuration consisting of only currently protected patches of scrub (no acquisition option) to the maximum configuration, where all remaining significant scrub patches were acquired for protection (complete acquisition option) (Stith 1999). The assumption was made that all areas that were protected were also restored and properly managed.

Results from Stith's (1999) simulation model included estimates of extinction, quasi-extinction (the probability of a Florida scrub-jay metapopulation falling below 10 pairs), and percent population decline. These were then used to rank the different statewide metapopulations by vulnerability. The model predicted five metapopulations (Northeast Lake, Martin, Merritt Island, Ocala National Forest [ONF], and LWR) have low risk of quasi-extinction. Two of the five (Martin and Northeast Lake), however, experienced significant population declines under the "no acquisition" option; the probability for survival of both of these metapopulations could be improved with more acquisitions.

Eleven of the remaining 21 metapopulations were shown to be highly vulnerable to quasi-extinction if no more habitats were acquired (Central Brevard, North Brevard, Central Charlotte, Northwest Charlotte, Citrus, Lee, Levy, Manatee, Pasco, St. Lucie, and West Volusia). The model predicted the risk of quasi-extinction would be greatly reduced for 7 of the 11 metapopulations (Central Brevard, North Brevard, Central Charlotte, Northwest Charlotte, Levy, St. Lucie, and West Volusia) by acquiring all or most of the remaining scrub habitat. The model predicted the remaining four metapopulations (Citrus, Lee, Manatee, and Pasco) would moderately benefit if more acquisitions were made.

Stith (1999) classified two metapopulations (South Brevard and Sarasota) as moderately vulnerable with a moderate potential for improvement; they both had one or more fairly stable populations of Florida scrub-jays under protection, but the model predicted population declines. The rest of the metapopulations could collapse without further acquisitions, making the protected populations there vulnerable to epidemics or other catastrophes.

Three of the metapopulations evaluated by Stith (1999) (Flagler, Central Lake, and South Palm Beach) were classified as highly vulnerable to quasi-extinction and had low potential for improvement, since little or no habitat is available to acquire or restore.

Status and distribution

The Florida scrub-jay was federally listed as threatened in 1987 primarily because of habitat fragmentation, degradation, and loss (Service 1987). Historically, oak scrub occurred as numerous isolated patches in peninsular Florida. These patches were 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, Florida scrub-jay populations occurred in the scrub 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. 1994a 1994b). Only the southernmost county, Monroe, lacked Florida scrub-jays (Woolfenden and Fitzpatrick 1996a). Although Florida 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). After 40 years of personal observation of the Etonia scrub (now known as Ocala National Forest), Webber (1935) observed many changes to the previously-undisturbed scrub habitat found there, noting that "The advent of man has created a new environmental complex."

A State-wide Florida scrub-jay census was last conducted in 1992 and 1993, at which time there were an estimated 4,000 pairs of Florida scrub-jays left in Florida (Fitzpatrick et al. 1994). At that time, the Florida scrub-jay was considered extirpated in 10 counties (Alachua, Broward, Clay, Duval, Gilchrist, Hernando, Hendry, Pinellas, and St. Johns), and were considered functionally extinct in an additional 5 counties (Flagler, Hardee, Levy, Orange, and Putnam), where 10 or fewer pairs remained. Recent information indicates there are at least 12 to 14 breeding pairs of Florida scrub-jays located within Levy County, higher than previously thought, and there is at least one breeding pair of Florida scrub-jays remaining in Clay County. A Florida scrub-jay has been documented in St. Johns County as recently as 2003. Populations are close to becoming extirpated in Gulf coast counties (from Levy south to Collier) (Woolfenden and Fitzpatrick 1996a). In 1992-1993, population numbers in 21 of the counties were below 30 or fewer breeding pairs (Fitzpatrick et al. 1994). Based on the amount of destroyed scrub habitat, Florida scrub-jay population loss along the LWR is 80 percent or more since pre-European settlement (Fitzpatrick et al. 1991). Since the early 1980s, Fitzpatrick et al. (1994) estimated in the northern third of the species' range, the Florida scrub-jay has declined somewhere between 25 and 50 percent. The species may have declined by as much as 25 to 50 percent in the last decade alone (Stith et al. 1996).

On protected lands, Florida scrub-jays have continued to decline due to inadequate habitat management (Stith 1999). However, over the last several years, steps to reverse this decline have occurred, and management of scrub habitat is continuing in many areas of Florida (Hastie and Eckl 1999; Stith 1999; TNC 2001; Turner et al. 2006). Fitzpatrick et al. (1994) indicated that fire suppression at Cape Canaveral and Cape Canaveral Naval Air Station threatens the viability of this core population of scrub-jays. Furthermore, they stated that current forestry practices on ONF are likely to contribute to the continued decline of scrub-jays in this core area. Scrub-jays occurring on private land also face continued threats due to habitat degradation, fragmentation, and loss.

Longspurred Mint

In addition to the assessment below, a 5-year review was completed in 2008 resulting in no change to the species designation (Service 2008b). The 5-year review builds upon the

detailed information in the Recovery Plan for Three Florida Mints (1987b) and is located at http://www.fws.gov/southeast/5yearReviews/5yearreviews/LongspurredMint.pdf

Species/critical habitat description

Dicerandra is a genus of seven species in the mint family (Lamiacea or Labiatae). Four species are annuals and three are shrubby, with woody bases and non-woody flowering shoots. Each has a strong minty odor. The three shrubby species are endangered. *D. cornutissima* grow to 1.6 ft tall and have sharply bent corollas with dark reddish- purple spots. This species has purple-rose flowers with geniculate floral tube in whorls on elongated flowering stems (Wunderlin 1980). Although this species has been confused with the related *D. fructescens,* this species is easily distinguished by its narrow leaves, purple-rose corolla, style with few hairs or naked, and anther appendage usually over 1mm long. Flowering occurs in September and October.
No critical habitat has been designated for Longspurred mint.

Life history

D. cornutissima is endemic to sand pine scrub habitat that can best be described as scrub composed of overstory of older mature sand pine (*Pinus clausa*), with an open to thick understory of sand live oak (*Quercus geminate)*, Chapman's oak (*Q. chapmanii)*, myrtle oak (*Q. myrtifolia)*, saw palmetto (*Serenoa repens)*, scrub palmetto (*Sabal etonia)*, Florida rosemary (*Ceratiola ericoides)*, and the state listed *Garberia heterophylla* (Herring 2005). The ground cover component of this habitat is composed of patchy occurrences of lichens (*Cladina evansii, Cladina subtenuis,* and *Cladonia leporine),* as well as grasses such as wiregrass (*Aristida stricta),* arrowfeather threeawn (*Aristida purpurescens*), and sandy field beaksedge (*Rhynchospora megalocarpa). D. cornutissima* grows well in open, sandy patches usually along roadside edges. Although *D. cornutissima* occurs in a fire-adapted habitat, the timing of fires related to the plants survivorship and reproduction is not known (Herring 2005).

At the Cross Florida Greenway (CFG), *D. cornutissima* mostly occurs within sand pine-dominated scrub that has a mosaic of sandhill throughout the site (Herring 2005). The overstory is open, consisting of mostly sand pine, but longleaf pines are occasionally found. Fire suppression in the sandhill has led to an invasion of sand pine, but prescribed burning of this area needs to be conducted carefully, since response of *D. cornutissima* is unknown (Herring 2005). Menges (1992) found that a similar species, *D. frutescens*, a short-lived perennial is killed by fire and re-establishes vigorously from seed. Weekley (2006) notes its close relative *D. christmanii* is also killed by fire and re-establishes from seed. There has recently been research (K. Holsinger, University of Connecticut, unpublished data, 2008) to show that longer intervals of fire (more than 12 years) may be optimum for these species. Therefore, research on the similar *D. frutescens,* which grows in yellow sand scrub at ABS on the LWR, should be considered to elucidate the effects of fire on *Dicerandra* species and help refine prescribed burning activities (A. Johnson, FNAI, personal communication, 2008).

Further east on the CFG, along the Interstate 75 right-of-way, and Marion Oaks and Ocala Waterway Estates subdivisions, *D. cornutissima* occurs along roadside edges, its preferred habitat (Herring 2005). Care must be taken along these edges to not move dirt, mow, and establish fire lines with heavy equipment (Herring 2005). There are plans at CFG to manage the scrub habitat using mechanical means to open the habitat and reduce the sand pine. Due to the close proximity of Interstate 75 to this site, prescribed burning is extremely difficult. The Office of Greenways and

Trails recently completed a management plan for CFG that has goals and objectives to protect, enhance, and increase *D. cornutissima* found on the site (FDEP 2007).

Population dynamics

D. cornutissima was originally found in Marion and Sumter Counties. Currently *D. cornutissima* is only known to occur at four sites in Marion County: CFG, along the Interstate 75 right-of-way, Marion Oaks subdivision, and Ocala Waterways Estates subdivision. A survey of the historic locations of *D. cornutissima* in Sumter County was conducted in 1984 and no plants were found (Wunderlin 1984). FNAI has a record of *D. cornutissima* south of Marion Oaks along a powerline in Sumter County in 1988. The site along the powerline was discovered after the recovery plan was written in 1987. The recovery plan states there was no suitable habitat left at the sites surveyed in 1984 in Sumter County, although suitable habitat may still exist between Sumter County and southern Marion County. (Service 1987b; Wunderlin 1984). Other FNAI records include plants on private lands in Marion County near Rainbow Lakes Estates in 1993 and along SR 200 (Bahia Oaks development) in 1991 (FNAI 1996a). No surveys of these sites have occurred since the early 1990s. Adjacent protected lands (Ross Prairie State Forest, Halpata Tastanaki Preserve, and Potts Preserve) have been surveyed the past 5 years but no *D. cornutissima* have been located in suitable habitat at these locations (A. Johnson, FNAI, personnel communication, 2008).

Monitoring of *D. cornutissima* has occurred as recently as 2008 at the CFG and the Interstate 75 right-of-way. At CFG over 14,000 plants were found and along the Interstate 75 right-of-way 731 plants have been documented. The two sites on private lands in Marion County (Marion Oaks and Ocala Waterway Estates subdivisions) have had periodic surveys but no long-term monitoring has occurred.

In 1975, *D. cornutissima* was first documented along the Cross Florida Barge Canal (now CFG) in sand pine scrub (Florida Game and Fresh Water Fish Commission 1976). This area at CFG was thought to have been extirpated in 1981; however, surveys in 1988 on the CFG Canal lands found six additional areas of *D. cornutissima* including the one area previously recorded in 1975 (Johnson 1988). In 1991, the Canal Authority transferred the land to the CFG. FNAI was then contracted to conduct a biological inventory in which they found four areas with this species where it had previously been found during the 1975 and 1988 surveys (Knight et al. 1991).

From 2001 to 2005, CFG again funded FNAI to conduct exotic and rare plant surveys at on their properties mentioned above, which included looking for areas with *D. cornutissima*. Five areas were located; three were historic areas already recorded with FNAI (Herring 2005).

Most recently (2007 to 2008), FNAI was contracted by CFG to perform a natural community mapping survey of the CFG. Also included in the mapping survey of natural communities were rare and exotic species surveys. Since the 2001-2005 surveys, the CFG had acquired additional land and *D. cornutissima* was found to occur at some of those new acquisitions. In particular, additional *D. cornutissima* were documented within Marion County, north and west of the Interstate 75 CFG Landbridge within a tract called "the triangle." *D. cornutissima* follows the western boundary of the CFG triangle along both sides of a firebreak that serves as an ecotone between the CFG scrub and what was (or currently is) the Ocala Waterway Estates subdivision. *D. cornutissima* also follows an east/west southern boundary of the triangle scattered along an open and deep, white, sandy road that borders sandhill. The eastern edge of the triangle borders the western side of Interstate 75 where additional *D. cornutissima* occur.

Since the first *D. cornutissima* survey of the CFG Canal (1975) to the present survey of the CFG (FDEP 2008), many *D. cornutissima* have been documented on this site. The majority of *D. cornutissima* at the CFG occurs west of Interstate 75 in the canal diggings along an east/west road within sandhill and scrub habitats. As described in the preceding paragraphs, *D. cornutissima* was also recently documented occurring along a north/south and southern boundary road of the triangle tract in primarily scrub habitat. East of Interstate 75, *D. cornutissima* has only been located in a few localities. Historically, before the habitat centering around what is now Interstate 75 in Marion County was urbanized (pre-interstate, Barge Canal, and housing subdivisions), the land was unfragmented and *D. cornutissima* probably occurred naturally throughout the scrub and sandhill in openings. Perhaps there was only one area of *D. cornutissima,* a huge and unfragmented occurrence. Today, it might be correct to consider *D. cornutissima* occurs in Marion County as a single area that has been fragmented from the Barge Canal diggings and associated roads, housing subdivisions, and Interstate 75. An estimate of the current number of *D. cornutissima* individuals on the CFG is approximately 14,222 plants (Herring, FNAI, personal communication, 2008).

In 1995, *D. cornutissima* was inadvertently impacted by construction of stormwater swales associated with road widening along Interstate 75 in Marion County. To mitigate these impacts, the FDOT agreed to leave sod off the new swale backslopes and investigate techniques to restore this species in suitable areas along Interstate 75. FDOT conducted a small study with three test plots in one of the excavated backslopes. One plot was sown with collected *D. cornutissima* seeds, one plot was planted with nursery-grown seedlings, and one plot was left unplanted. Both of the planted plots achieved high seedling survival (although germination rates were low), and more *D. cornutissima* grew in these plots than in the unplanted plot. However, because of the small numbers of plants and the lack of replicates to test the variables among the plots, it was not possible to determine if active planting is superior to passive recruitment. Many new plants were informally observed growing in the un-sodded backslopes outside the test plots, and in 2005, surveys located additional plants outside the test plots along both the west and east sides of Interstate 75 in Marion County (Herring 2005). The successful seedling survival in the planted plots holds promise for re-establishing extirpated populations in areas where habitat has been restored.

During the 2005 FNAI survey, a total of 731 *D. cornutissima* plants were documented on the Marion County, FDOT Interstate 75 right-of-way with 344 plants occurring along the west side and 387 plants recorded on the east side of the interstate. Some of the *D. cornutissima* along the west side of Interstate 75 have spread under the CFG boundary fence where there are openings in the thick scrub there.

Dicerandra cornutissima was also historically located north and south of the CFG in the Marion Oaks subdivision and Ocala Waterway Estates subdivisions. Although the 1987 recovery plan documented several thousand plants at both sites (Service 1987b), no recent surveys have been conducted. There were two general areas within Marion Oaks where *D. cornutissima* were found, the northern end along County Road 484 and the southern end near the Sumter County line. Habitat loss from an increase in development has occurred at these sites in recent years, so additional surveys should be conducted to determine if these areas are still occupied and to what extent. Historic records show that *D. cornutissima* also was found at Rainbow Lakes Estates (1993) and along SR 200 near the Bahia Oaks development (1991) in Marion County, as well as, south of Marion Oaks along a powerline in Sumter County (1988). Surveys are needed to determine if these areas are still occupied by *D. cornutissima.*

Status and distribution

When listed in 1985, *D. cornutissima* was only found at four locations, along Interstate Interstate 75, CFG Canal, and two residential subdivisions (Ocala Waterway Estates and Marion Oaks). *D. cornutissima* still occurs at these sites. Within Marion Oaks subdivision, this species was found along the northern end near County Road 484 and southern end (about 4 miles south) near the Sumter County line. In 1938 and 1946, *D. cornutissima* was found in northern Sumter County 7 miles south of the Marion Oaks Subdivision. In 1984, no suitable habitat was found at these sites when surveyed (Wunderlin 1984). Other historic locations include areas south of Marion Oaks along a powerline in Sumter County (1988), near Rainbow Lakes Estates (1993) in Marion County, and along SR 200 near the Bahia Oaks development (1991) in Marion County. Only the site near Rainbow Lakes Estates appears to still have suitable habitat (A. Johnson, FNAI, personal communication, 2008). However, surveys are needed to determine if these areas are still occupied by *D. cornutissima.*

Dicerandra cornutissima was originally found along the right-of-way of the CFB Canal in 1975 (FWC 1976). This population was thought to have been extirpated in 1981; however, Johnson located it in 1988 at several other locations along the CFB Canal. In 1991, after the CFB Canal Project was abandoned, the property was acquired by the State of Florida and leased to the FDEP and is now managed by the Office of Greenways and Trails. A biological inventory of CFG was conducted in 1991, which located the same areas with *D. cornutissima* during the 1975 and 1988 surveys of CFG (Knight et al. 1991). Surveys conducted by FNAI from 2001 to present have located this species along additional roads and the old barge canal right-of-way (Herring 2005).

Along the Interstate 75 right-of-way, *D. cornutissima* is currently being managed by FDOT. FDOT has managed these sites by avoiding mowing in areas occupied by this species as well as eradicating invasive cogon grass at many of the sites where *D. cornutissima* occurs along Interstate 75. The densest populations of *D. cornutissima* appeared in the viewsheds of several billboards and along the fence lines after the impacts from the roadside construction occurred. The vegetation in the billboard viewsheds appeared to be maintained at a few feet in height, possibly by bush-hogging every few years, and the fence lines were disked by FDOT every
few years. Shortly thereafter, the billboards were removed and the viewsheds are no longer maintained, and disking along the fence line was discontinued. The density of *D. cornutissima* appears to have decreased in both the former viewsheds and along the fence lines (Stephen Tonjes, FDOT, personal communication, 2008).

In 1987, two large tracts of privately owned land that make up the Marion Oaks and Ocala Waterway Estates subdivisions contained the largest populations of several thousand plants each (Service 1987b). During the late 1980s and early 1990s, both subdivisions were more or less abandoned; however, development has begun to increase in both of these areas. *D. cornutissima* was found historically along the road rights-of-way in the sand pine scrub in these subdivisions. The current distribution of this species is unknown at these sites.

ENVIRONMENTAL BASELINE

The environmental baseline is an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species, its habitat (including designated critical habitat), and ecosystem within the action area. The environmental baseline does not include the effects of the action under review in this Biological Opinion.

Status of the species within the action area

Sand Skinks and Blue-tailed mole skink

Skinks were not directly observed during general wildlife and habitat surveys in 2014; however, the characteristic sinusoidal tracks of skinks were detected in Lake, Polk, and Osceola Counties, Florida. Between March 10 and May 8, 2015, at the request of the FWS, Sabal Trail conducted coverboard surveys to confirm skink presence/absence. The coverboard surveys were completed in all suitable skink habitats using approved survey protocols developed in conjunction with the FWS. Based on the cover board surveys and the pedestrian surveys that were completed in 2104 and 2015, skinks were confirmed present at two sparse grass/pasture habitat sites and assumed present in four additional native xeric habitats. It was reasonable to expect sand skink to be present in close proximity to occupied areas where surface soil, land use, and land cover are identical and there are no physical barriers to skink movement. Based on the current configuration of the project's construction workspace, 25.5 acres of known or presumed occupied skink habitat would be impacted by the project.

Sabal Trail conducted habitat analysis for the sand skink (Sabal Trail Interim report, February 2015) throughout the range of the species based on past surveys, suitable soils, and habitat conditions to determine the extent of areas that needed to be surveyed. Through this analysis it was determined that sand skinks are dependent on suitable soils that are "swimmable". Even when suitable soils are present if the habitat type has been human-altered such as road, buildings, or areas containing sod-forming grasses, such as bahia, St. Augustine, and cogon, this created "unswimmable" soils that skinks will avoid. Native xeric had the highest occupancy rate (92.29% of sites surveyed) of any habitat type and was the most frequently surveyed. It was also found that sand skink population source controls the probability of recolonization of previously disturbed sites and that future occupancy of connected sites is tightly linked to habitat quality. Intensively disturbed sites such as active citrus sites are mostly unoccupied even if a nearby sand skink source population is available. In human-altered landscapes with "swimmable" soils, Florida sand skinks recolonize a substantial portion of such sites once the disturbance is relaxed or discontinued if the site is connected to native xeric habitat (Sabal Trail report, May 2015)

Construction corridors for Sabal Trail in occupied sand skink habitat will be narrow, 100 feet in width. We have confirmed through field reviews and GIS analysis that in no case will the entirety of the occupied sand skink habitat (known or presumed) be cleared during construction, i.e., in all locations of sand skink habitat disturbance adjacent/abutting sand skink habitat is present and will remain post-construction to serve as potential sources for recolonization. Sand skinks presence was confirmed in 93% of 1,216 native xeric habitat sampling locations, and native xeric is the dominant occupied (known or presumed) habitat and will provide a source for recolonization (Sabal Trail

Interim Report, February 2015). Sabal Trail provided the Service a document- Reasonable Assurance That Florida Sand Skinks Will Occupy The Southeast Market Pipelines Construction Corridor Following Construction (May 2015) that provided several examples where the consultant documented that after the habitat had been altered, recolonization occurred.

Sabal Trail has provided the Service with reasonable assurance to support a determination that, as a result of various proposed pre- and post-construction impact conservation measures, sand skinks either will not be temporarily extirpated from the pipeline corridor following construction or will recolonize the corridor from adjacent occupied habitat once construction is completed.

Sabal Trail will conduct post-construction pedestrian surveys for sand skinks on a subsample of 25% of known, previously occupied areas (only). A maximum of three pedestrian surveys would be conducted at least two weeks apart in the spring survey window for Florida sand skink (March 1-May 15; USFWS 2013) until sand skink are either observed or for up to three years following pipeline construction in the selected areas. Survey areas will be selected to only include areas where sand skinks were detected during pre-construction surveys. Surveys will be limited to the 50-foot permanent easement area for each project and will include both the trenched pipeline area and the surrounding easement area. In the event that sand skinks are detected, no further surveys of that site will be conducted. Survey area selection will be based on ease of access, landowner approvals, and counts of sand skink trails from pre-construction surveys. Survey area selection may change from year-to-year if landowner access is denied or if the landowner converts the habitat to a condition unsuitable for sand skink. No surveys will be conducted in active citrus, as this habitat type is subject to continual disturbance independent of pipeline activities

Based on survey results, FERC has determined the proposed portions of the Sabal Trail pipeline "may affect and is likely to adversely affect" the sand skink. The Service concurs with this determination and finds that the project will result in adverse effects to the federally listed sand skink and its habitat. The project's effects on the sand skink will be discussed in the Effects of the Action.

Eastern indigo snake

The FWC Fish and Wildlife Research Institute indicates potential habitat for the indigo occurs in southern Lake County near the Green Swamp and Richloam Wildlife Management Area, southwestern Marion County near the Ross Prairie Ecosystem (including Halpata Tastanaki Preserve), Gilchrist County near Dry Prairie Hammock, southern Suwannee County near the Suwannee River, and western Hamilton County near the Withlacoochee River. Because indigos often inhabit gopher tortoise burrows, the indigo may be present in all areas that have been identified as gopher tortoise habitat. Sabal Trail did not conduct species-specific surveys for the indigo, but biologists observed one live adult indigo and collected one confirmed adult indigo shed from a second location within the project area during general habitat surveys. Both observations were associated with native upland habitats containing gopher tortoise burrows in areas associated with the Ross Prairie Ecosystem. Following submittal of the August 2015 listed species report, an additional adult indigo snake was observed by Sabal Trail near the Suwannee River in Gilchrist County.

Based on survey results, FERC has determined the proposed portions of the Sabal Trail pipeline "may affect and is likely to adversely affect" the eastern indigo snake. The Service concurs with this determination and finds that the project will result in adverse effects to the federally listed sand skink and its habitat. The project's effects on the sand skink will be discussed in the Effects of the Action.

Florida scrub-jay

Sabal Trail completed Florida scrub-jay surveys in 2014 and 2015 in accordance with the Comprehensive Listed Species Survey Protocol Document developed in conjunction with and approved by the FWS. Seven scrub-jay territories were identified in Citrus, Marion, and Sumter Counties, Florida. In Territory 1, two adult scrub-jays were observed and responded to calls during 2014 surveys while defending a territory associated with a utility corridor and active blueberry farm. Sabal Trail resurveyed Territory 1 in June 2015. Surveyors observed that the previously occupied territory within Sabal Trail's proposed construction workspace had been mechanically cleared and the scrub to the south of the existing utility corridor had been disturbed. Scrub-jays did not respond to two separate playback call events within the right-of-way or to playback calls south of the existing utility corridor. Due to habitat loss and alteration, scrub-jays are no longer present at Territory 1.

In Marion County, two scrub-jay territories consisting of scrub habitat were observed near Marion Oaks during 2014 surveys. Territory 2 is approximately 28 acres in size (0.6 acre within the proposed construction workspace) and consists of two adults and one subadult. Territory 3 is approximately 15 acres in size (0.2 acre within the construction workspace) and consists of four adults and two yearlings. The majority of both territories are south of the proposed pipeline workspace.

In Sumter County, four scrub-jay territories were identified in close proximity to one another within and adjacent to a maintained electric transmission line corridor. Territory 4 is approximately 76 acres in size (11 acres within the proposed construction workspace) and consists of two adults and a juvenile. Territory 5 is approximately 65 acres in size (8.5 acres within the proposed construction workspace) and consists of two adults, two helpers, and a juvenile. Each of these families utilizes low scrub oak in the utility corridor as its primary and nesting habitat and the adjacent overgrown shrub as refuge from predators.

Surveys in 2014 identified Territories 6 and 7, which consisted of degraded scrub habitat and contained families of at least two adults. Territories 6 and 7 were resurveyed on two occasions in 2015. During the first survey event, 4 adults arrived from the east of the territories and did not exhibit territorial responses to playback calls, which indicate the territories may no longer be utilized by scrub-jays. On the second survey event, the degraded scrub habitat was cleared and the area converted to agricultural use. Due to habitat loss, scrub-jays are no longer present at Territories 6 and 7.

Based on survey results, FERC has determined the proposed portions of Sabal Trail "may affect and is likely to adversely affect" the Florida scrub-jay. The Service concurs with this determination and finds that the project will result in adverse effects to the federally listed Florida scrub jay and its habitat. The project's effects on the Florida scrub jay will be discussed in the Effects of the Action.

Longspurred mint

Sabal Trail surveyed appropriate habitats for the longspurred mint in Marion County in late September through October 2014 during the preferred flowering period. Surveys in June 2015 were conducted by expert botanists that were approved by FWS to complete surveys outside the survey window for the species. Habitat was not surveyed if it appeared to be managed for fire exclusion and exhibited dense, closed canopy, was converted to pasture with dense grass cover, or was converted to pine plantation or citrus grove. Groupings of longspurred mint were identified between Mainline MPs 398 and 405.

Based on survey results, FERC has determined the proposed portions of the Sabal Trail pipeline "may affect and is likely to adversely affect" the longspurred mint. The Service concurs with this determination and finds that the project will result in adverse effects to the federally listed plant and its habitat. The project's effects on the longspurred mint will be discussed in the Effects of the Action.

Factors affecting species' environment within the action area

The habitats surrounding the action area are threatened by degradation resulting from fire exclusion, lack of management, and residential development. As mentioned in the previous section, some suitable habitat is interspersed within the residential and compacted pastureland. Xeric habitats require periodic fire to maintain optimal habitat values such as patches of bare sand and low shrub architecture. The need to protect agricultural, residential, and commercial development has resulted in the suppression of wildfires. Xeric habitats lacking periodic fire or management become overgrown and less suitable to the species addressed above. Over time, these species will diminish in abundance and eventually may be extirpated. Sabal Trail has no mechanism to perpetuate land management practices beyond their right-of-way, so the maintenance of scrub habitat suitability surrounding the action area will be the responsibility of individual property owners.

Climate Change

The Intergovernmental Panel on Climate Change (IPCC) concluded that warming of the climate system is unequivocal (IPCC 2007a). Numerous long-term changes have been observed including changes in arctic temperatures and ice, and widespread changes in precipitation amounts, ocean salinity, wind patterns, and aspects of extreme weather including droughts, heavy precipitation, heat waves, and the intensity of tropical cyclones (IPCC 2007b). While continued change is certain, the magnitude and rate of change is unknown in many cases.

Climatic changes in Florida could amplify current land management challenges involving habitat fragmentation, urbanization, invasive species, disease, parasites, and water management (Pearlstine 2008). Based on current predictions, global warming will be a particular challenge for endangered, threatened, and other "at risk" species. However, it is difficult to estimate, with any degree of precision, how these species will be affected by climate change. Although, these species occur on high sandy ridges, they may be sensitive to changes in rainfall patterns or changes in seasonal temperatures. The Service will use Strategic Habitat Conservation Planning, an adaptive science-driven process that begins with explicit population objectives, as the framework for adjusting our management strategies in response to climate change (Service 2006b).

EFFECTS OF THE ACTION

This section includes an analysis of the direct and indirect effects of the proposed action on the species and/or critical habitat and its interrelated and interdependent activities on federally listed Florida sand skink, blue-tailed mole skink, eastern indigo snake, Florida scrub-jay, and longspurred mint and their habitat. The Service has evaluated the identified temporary construction activities in the context of how the individual actions have the potential to produce adverse effects to the covered species – at the individual, population, and landscape scales. The Service believes that, as implemented, the Conservation Measures will result in ameliorating, minimizing, or eliminating potential adverse effects. The use of specific Conservation Measures focusing on design, timing, method of operation of machinery, and the natural revegetation of the action areas is expected to significantly reduce the potential adverse effects from construction activities. However, even with the implementation of the Conservation Measures, some remaining adverse effects will occur to the covered species as described below.

Direct effects

Direct effects are those effects that are caused by the proposed action, at the time of construction, are primarily habitat based, and are reasonably certain to occur. Direct effects include: the permanent and temporary loss of habitat for the covered species and a reduction in the geographic distribution of their habitat.

Interrelated and interdependent actions

An interrelated activity is an activity that is part of the proposed action and depends on the proposed action for its justification. An interdependent activity is an activity that has no independent utility apart from the action under consultation.

Indirect effects

Indirect effects are those effects that result from the proposed action, are later in time, and are reasonably certain to occur.

Beneficial effects

Beneficial effects are those effects of the proposed action that are completely positive, without any adverse effects to the listed species or its critical habitat. The proposed action will be temporary in nature and will allow for habitat restoration once the proposed project is complete.

Factors to be considered

Physical Disturbance (Including Noise)

All of the covered conservation measures, either directly or indirectly, have the potential to produce some additional level of physical disturbance because they involve the physical presence of humans and/or associated equipment, vehicles or machinery. Further, future periodic disturbances have the potential to occur as maintenance actions for the implemented practices that may be needed over their operational life. Although effects are not quantitatively known the literature suggests some

form of physical effects from presence and/or associated noise will create a disturbance response to individuals of each of the covered species.

The net effect of the physical disturbance including sustained sources of noise may be a localized reduction of survival or productivity, avoidance of otherwise suitable habitat, and/or reduction of breeding frequency. These effects are expected to rarely occur and are not expected to produce substantial changes in species distribution and abundance. However, some small level of mortality is likely, since detection of those individuals while the habitat is disturbed is highly unlikely.

Temporary Soil Disturbance and Vegetation Removal

Temporary soil disturbance and vegetation removal are expected from the implementation of pipeline construction activities. This disturbance may result in loss and/or temporary change in habitat conditions for the covered species. Sources of the disturbance would include use of equipment (tractors, and other machinery) as well as practices that involve manipulation of vegetation (e.g., hydroaxe or other mechanical means to remove vegetation). The installation of the pipeline could result in soil surface disturbance and/or compaction. The ground disturbance may involve minor surface disturbance such as tracked vehicles or tires. Common potential adverse effects identified by the Service include short-term degradation of habitat conditions and the potential for increased habitat fragmentation if the scale of the disturbance is large enough and there's the potential to create opportunities for colonization of these disturbed sites by invasive plants.

Temporary adverse effects on individuals can include increased levels of stress hormones, increased recesses during incubation (*i.e.*, may increase detection by predators and predation risk), or disturbance/flushing of young. If these risks are realized, individual fitness is reduced and may have population-level effects if disturbance is over a broad enough spatial or temporal scale.

Permanent Removal/loss of Suitable Habitat

This adverse effect is a result of permanent removal of habitat conditions and specific vegetative loss caused by pipeline construction or the expectation that, once implemented, permanent degradation of habitat conditions for any of the covered species will have resulted.

The primary adverse effect is the permanent loss of habitat that can lead to a subsequent decline in populations of the covered species. However, any permanent loss of habitat is expected to be small in scale and will not substantially affect population trends or result in quantifiable additional habitat fragmentation effects.

Increased Potential of Accidental Mortality to Individuals

Several construction activities were identified as potentially causing mortality or injury to individuals of listed species. These include accidental mortality from collisions with vehicles or, in the case of plants, loss of individual plants due to crushing or as a result of vegetative manipulation.

Analyses for effects of the action on specific species

Blue-tailed Mole Skink and Florida sand skink

Direct Effects- Skinks that may be present within the construction workspaces or within areas that are maintained during operation of the pipeline could be injured or killed by construction activities, such as vegetation clearing and removal, debris piling (soil stock piling), potential burning, construction, restoration, and equipment traffic along the right-of-way and access roads. Mechanical preparation of the Sabal Trail site can crush or injure individual skinks and skink eggs, and destroy or degrade occupied and potential habitat and foraging areas. In addition, any clearing activities may adversely affect skinks by causing them to leave the area and possibly miss foraging and mating opportunities. Individual skinks fleeing the area may be more vulnerable to predation.

Sand skinks may respond to the commencement of construction activities by attempting to flee the project site to avoid the disturbance. However, because skinks are not highly agile, they may not be able to successfully flee the project site before they are affected by construction activities. As such, skinks may be crushed by construction vehicles or entombed during earth moving, contouring and trenching activities associated with the construction of the proposed pipeline.

Occupied habitats would be temporarily lost during construction and pipeline maintenance activities and would not be suitable for use until restoration is complete. Additionally, if the pipeline right-of-way is restored to full vegetation cover, suitable swimmable soil conditions may render the habitat useless and create a barrier for skink movement.

Indirect Effects- Indirect effects are those effects that result from the proposed action, are later in time, and are reasonably certain to occur. Unintentional yet often unavoidable indirect effects of a maintaining the proposed pipeline is increased incidences of vehicle wildlife collision resulting in road kill. The project should not cause fragmentation of skink habitat within thee skink home ranges since there will not be any permanent loss of habitat and any habitat temporarily impacted will be returned to the original condition and allowed to naturally revegetate.

Eastern indigo snake

Direct Effects- Construction and maintenance activities would temporarily displace indigos from suitable foraging, burrowing, resting, or wintering habitat. Because indigos use a variety of habitats, construction and maintenance of the pipeline should result in a minimal loss of habitat, and is not expected to result in long-term or cumulative loss of habitat. Construction and operational activities are not expected to result in a noticeable loss of prey species for the indigo. Wherever possible, Sabal Trail would temporarily exclude gopher tortoises from the construction workspace and allow them to return to the right-of-way once construction and restoration is complete.

Direct mortality of indigos may occur from vehicle or equipment strikes or if snakes become trapped in an open trench. Indigo are a mobile species and in most instances, would be capable of avoiding approaching vehicles and/or equipment. However, indigo fatalities from vehicle strikes are common. In addition, some individuals will be captured and handled, which is anticipated to cause short-term stress. Efforts will be made to handle them for the least amount of time possible and to release them unharmed in the nearest available suitable habitat to minimize stress. Feeding,

sheltering, and reproduction could be interrupted as a result of capture; however, these behaviors are expected to return to normal following release.

Indirect Effects- Indirect impacts on indigos adjacent to the construction or maintenance workspaces may occur from pedestrian, equipment, and vehicular traffic, as well as vibration from these activities. Although construction personnel would be advised to avoid snakes through informational posters and pamphlets, the operation of equipment in brushy, grassy, or otherwise vegetated areas may disturb snakes that are not readily visible. Construction and restoration of the project is proposed to occur year-round, and activities would generally occur during daylight hours when indigos are active.

Florida Scrub-jay

Direct Effects- Potential effects from the project on scrub-jays could include loss of active nests, eggs, and/or fledglings if the project were constructed during the nesting season (typically March 1 to June 30) and displacement of individuals from otherwise suitable foraging habitats along the project. Construction activities could also disrupt nesting activities adjacent to the proposed construction workspace.

Indirect Effects- These would include the permanent loss of scrub habitat from maintenance clearing along the permanent pipeline right-of-way. While some low woody growth may be allowed in the permanent right-of-way, nesting habitat would be permanently lost. Additionally, scrub habitat in the temporary construction workspace may not be suitable for use by Florida scrub-jays for a number of years after initial right-of-way restoration is complete.

Longspurred Mint

Direct Effects- Construction and operation of the pipeline would directly impact small portions of the populations that were identified during surveys; however, maintenance of the pipeline right-of-way may create additional suitable habitat for the species. Sabal Trail would place safety fence along the eastern edge of the construction right-of-way along the largest area of existing plant population prior to commencing construction activities in order to reduce disturbance to populations adjacent to the right-of-way. Signs indicating an environmental sensitive area would be placed with the safety fence.

Indirect Effects- The habitat in the temporary construction workspace may be suitable for use by longspurred mint for a number of years after initial right-of-way restoration is complete. The FERC Upland Erosion Control, Revegetation, and Maintenance Plan (Plan) specifies that "Routine vegetation mowing or clearing over the full width of the permanent right-of-way in uplands shall not be done more frequently than every three years. However, to facilitate periodic corrosion/leak surveys, a corridor not exceeding 10 feet in width centered on the pipeline may be cleared at a frequency necessary to maintain the 10-foot corridor in an herbaceous state. Since the current population is found in an adjacent existing maintained electric transmission line right-of-way, the limited vegetation mowing or clearing allowed by the FERC Plan should provide a suitable habitat for this species.

Analyses for effects of the action

To minimize potential impacts to covered species and scrub habitat, the applicant coordinated with the Service to avoid high-quality scrub habitat during the project planning for the proposed pipeline. To minimize the population effects for the loss of the covered species and their habitats, the applicant proposed conservation measures addressed earlier as a part of the proposed action. We expect the majority of incidental take will be in the form of death, injury, or temporary harassment (via displacement) during Conservation Measures implementation. For some Conservation Measures, a portion of incidental take is expected over the life of the proposed pipeline. The scale of the effect will be landscape specific, but will most likely involve mortality of some members of the species covered in this Opinion.

Indirect effects will be minimized by implementing the Conservation Measures proposed by Sabal Trail.

We know that there are areas within the proposed pipeline that are occupied by the covered species. Eastern indigo snakes have been observed in Marion County and Gilchrist counties within the proposed pipeline. Seven Florida scrub-jay families' territories were detected within the proposed pipeline. Only a portion of four territories will be temporarily impacted during initial clearing of the proposed pipeline project. The habitat is currently overgrown scrub and after construction will be allowed to revegetate and provide open patches more suitable for scrub-jays. It is difficult to quantify abundance of the sand skink and blue-tailed mole skink due to the cryptic nature of the species and survey methodology. Therefore, the actual number of skinks that currently occupy the site are unknown. The Service has determined that the acres of occupied scrub habitat are a quantifiable proxy for the jeopardy analysis and allows the Service to quantify and monitor take of the species. Results of the surveys suggest that federally listed sand skinks occur within 25.5 acres of Sabal Trail. Based on estimated acres of protected lands that manage for sand skinks and scrub species, the proposed loss of occupied habitat is insignificant amount, less than .04% (assuming 29,511 acres, Mushinsky et al 2011). The Service acknowelges that this may be a conservative estimate because of limited range-wide data regarding sand skink population size at all protected sites in the remaining scrub habitat. Based on the best available information, the Service has determined that the loss would not jeopardize the recovery or continued existence of the covered species.

CUMULATIVE EFFECTS

The Service defines "cumulative effects" considered in this Biological Opinion as the effects of future State, Tribal, local, or private actions (*i.e.,* non-Federal actions) reasonably certain to occur in the action area. Our definition of cumulative effects does not include future Federal actions unrelated to the proposed action because these actions require separate consultation pursuant to section 7 of the Act. Cumulative effects are considered in regard to the risk of the proposed action having an effect that would jeopardize the recovery and continued existence of the species. Any take resulting from cumulative effects would be addressed by the Service through the ESA's section 10 process.

The Service does not know of any future projects that would occur within the action area at this time.

CONCLUSION

After reviewing the current status, environmental baseline for the action area, effects of the proposed action, and cumulative effects to the covered species, it is the Service's Biological Opinion that the proposed action is not likely to jeopardize the continued existence of these species. We base this decision on the following:

1. Implementing the proposed conservation measures will limit the amount of "take" to these species.
2. While the project shall result in a reduction of available scrub habitat, sufficient suitable habitat is currently protected in other areas of the ranges of these species.

INCIDENTAL TAKE STATEMENT

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

Section 7(b)(4) and 7(o)(2) of the Act generally do not apply to listed plants and candidate species. However, limited protection of listed plants from take is provided to the extent the Act prohibits the removal and reduction to possession of Federally listed endangered plants or the malicious damage of such plants on areas under Federal jurisdiction, or the destruction of endangered plants on non-Federal areas in violation of State law or regulations, or in the course of any violation of a State criminal trespass law. If this project is on private land and the landowner is not the project proponent, in addition to landowner permission, a Florida Department of Agriculture and Consumer Services permit for plants may be needed. To determine if such a permit is necessary or to apply for this permit, contact:

Florida Department of Agriculture and Consumer Services
Florida Division of Forestry
Plant Conservation
3125 Conner Boulevard
Tallahassee, Florida 32399-1650
Telephone: 850-414-8293
Fax: 850-921-6724

AMOUNT OR EXTENT OF TAKE

Blue-tailed mole skink and Florida sand skink

The Service has reviewed the biological information for this species, the information presented by the applicant, and other available information relevant to this action. The Service anticipates incidental take of sand skinks in the form of harm (*i.e.,* mortality and habitat loss). Construction activities associated with the project may wound or kill skinks, and result in the loss 25.5 acres of sand skink habitat. The Service finds the actual number of sand skinks incidentally taken by the action will be difficult to quantify for the following reasons: 1) individuals have a small body size and spend the majority of their time underground, making the detection of a dead or impaired specimens unlikely; and 2) a commercially practicable and suitable survey method has not been developed to accurately estimate skink density, thus the number of skinks currently occurring in the project footprint is not well known. The Service finds that all sand skinks occurring within the 25.5 acres of skink habitat on the project site will be taken incidental to the action.

Eastern indigo snake

The Service anticipates incidental take of eastern indigo snakes will be difficult to detect and quantify for the following reasons: wide-ranging distribution; a patchy distribution within suitable habitat; limited detectability due to use of burrows or holes for shelter; there is likely unoccupied suitable habitat; juveniles have limited detectability due to their affinity for thick vegetation; and the use of cryptic sheltering areas that may be temporarily established during construction (*e.g.*, brush piles, equipment stockpiles, and dirt mounds). The lack of practical methods to survey, in conjunction with wide-ranging activity and use of a variety of habitat types makes it difficult to determine the exact number of eastern indigo snakes that will be incidentally taken.

The Service anticipates that incidental take may occur throughout the entire project area (481.6 acres) in the form of harm or harass during project construction activities. Incidental take related to the project may occur in the action area, particularly from construction traffic within the project area. Since the construction of project is temporary and the habitat will be restored the entire range of one male or female eastern indigo snake will not be impacted. Based on best available science and implementation of the conservation measures the Service is authorizing incidental take in the form of injury or mortality of no more than two eastern indigo snakes and no more than ten eastern indigo snakes in the form of capture and harassment as associated with the relocation of the eastern indigo snake from the construction work area during construction of the pipeline and no more than four eastern indigo snake egg clutches. If additional eastern indigo snakes are taken during the construction of the project then our office should be contacted and reinitiation may be needed.

Florida scrub-jay

The Service has reviewed the biological information for this species, information presented by the applicant's consultant, and other available information relevant to this action. The Service anticipates incidental take of scrub-jays in the form of harm (*i.e.,* mortality and habitat loss). Based on our review, incidental take is anticipated to include 20.3± acres of scrub-jay habitat occupied by four (4) families consisting of three (3) to four (4) individuals in each family. However, the loss of the habitat within the territories will be temporary and naturally revegetate providing sandy open areas and suitable habitat.

EFFECT OF THE TAKE

In the accompanying Biological Opinion, the Service determined this level of anticipated take is not likely to result in jeopardy to the covered species. Critical habitat has not been designated for any of these species and therefore, will not be affected.

REASONABLE AND PRUDENT MEASURES

When providing an incidental take statement, the Service is required to give reasonable and prudent measures it considers necessary or appropriate to minimize the take along with terms and conditions that must be complied with, to implement the reasonable and prudent measures. The Service has determined that the following reasonable and prudent measures are necessary and appropriate to minimize the take of the covered species.

1) FERC and Sabal Trail shall ensure the level of incidental take anticipated in this Biological Opinion is commensurate with the analysis contained herein.

The conservation measures proposed by the applicant and as described as a part of the project description are considered binding measures and shall be implemented for the exemption in section 7(o)(2) to apply. In the event that a sick, injured, or dead species is found, the Service has provided the following procedures to be used to handle or dispose of any individuals taken.

Terms and Conditions

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

1.1 The construction of the pipeline project will be clearly delineated prior to ground disturbance to ensure that take is not exceeded within the known occupied areas for all covered species. Habitat acres were used as a proxy to quantify take, and if, during the course of this action, this level of take is exceeded; such take would represent new information requiring reinitiating of the proposed action.

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

1.3 Disposition of Sick, Injured, or Dead Specimens-To ensure that upon locating a dead, injured, or sick threatened or endangered species, initial notification must be made to the nearest Service Law Enforcement Office: U.S. Fish and Wildlife Service; 9549 Koger Boulevard, Suite 111; St. Petersburg, Florida 33702; 727-570-5398. Secondary notification should be made to the Florida

Fish and Wildlife Conservation Commission: South Region; 3900 Drane Field Road; Lakeland, Florida; 33811-1299; 1-800-282-8002.

CONSERVATION RECOMMENDATIONS

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

The Service is recommending the removal of any plastic netting found along the right-of-way. Plastic netting should not be used in the future because it does not degrade over time and can entrap and kill many species of wildlife.

REINITIATION NOTICE

This concludes formal consultation on Sabal Trail pipeline project. As provided in 50 CFR § 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded (see below); (2) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this Opinion; (3) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this Opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending re-initiation.

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APPENDIX 2

U.S. Fish and Wildlife Service Biological Opinion
25 May 2016
(FSC Project)

United States Department of the Interior

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

May 25, 2016

Kimberly D. Rose, Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Room 1A
Washington, DC 20426

Service CPA Code:	04EF2000-2014-CPA-0203
Service Consultation Code:	04EF2000-2014-F-0280
FERC Docket Number:	CP14-554-000, OEP/DG2E/Gas Branch 3, Florida Southeast Connection, LLC.
Date Received:	November 01, 2013
Formal Consultation Initiation Date:	March 17, 2016
Project:	Florida Southeast Connection
Applicant:	Federal Energy Regulatory Commission
County:	Osceola, Polk, Okeechobee, St. Lucie, and Martin

Dear Ms. Rose:

This document transmits the U.S. Fish & Wildlife Service's (Service) South Florida Ecological Service's Field Office Biological Opinion based on our review of construction and operation of Florida Southeast Connection, LLC's (FSC) Florida Southeast Connection pipeline project (Project) and its effects on the blue-tailed mole skink (*Plestiodon egregious lividus*) and sand skink (*Plestiodon reynoldsi*) (collectively referred in this document as skinks unless specified), as well as the Florida bonamia (*Bonamia grandiflora*), Lewton's polygala (*Polygala lewtonii*), papery whitlow-wort (*Paronychia chartacea spp. Chartacea*), sandlace (*Polygonella myriophylla*), scrub buckwheat (*Eriogonum longifolium var.gnaphalifolium*), and scrub mint (*Dicerandra frutescens*) in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*). The Project is a 126.3-mile gas pipeline proposed to run through five Florida counties (Osceola, Polk, Okeechobee, St. Lucie and Martin) within the South Florida Ecological Service's Field Office jurisdiction. The Project is part of the larger Southeast Market Pipeline (SMP), which includes Transcontinental Gas Pipe Line Company, LLC's Hillabee Expansion (43.5 miles) and Sabal Trail Transmission LLC's Sabal Trail (516.2 miles) pipeline projects, both of which were considered in the North Florida Ecological Service's Biological Opinion (Service Log

No. 04EF1000-2014-F-0319). The Federal Energy Regulatory Commission (FERC) requested consultation on two mammals, eleven birds, eight reptiles, one insect, and twenty four plants (Table 1). FERC's request for formal consultation was received on September 9, 2015.

Table 1. Species included in FERC's consultation request for the Project. (E = endangered, T = threatened, E, XN = endangered non-essential experimental population in the eastern U.S. and Louisiana, SAT = threatened due to similarity of appearance, Pet =petitioned, and C = candidate species)

Species
MAMMALS
Florida bonneted bat (E) *Eumops floridanus*
Florida panther (E) *Puma concolor coryl*
BIRDS
Audubon's crested caracara (T) *Caracara cheriway*
Everglade snail kite (E) *Rostrhamus sociabilis plumbeus*
Florida grasshopper sparrow (E) *Ammodramus savannarum floridanus*
Florida scrub-jay (T) *Aphelocoma coerulescens*
Kirtland's warbler (E) *Setophaga kirtlandii*[1]
Piping plover (T) *Charadrius melodus*
Red-cockaded woodpecker (E) *Picoides [=Dendrocopos] borealis*
Red knot (T) *Calidris canutus rufa*[1]
Whooping crane (E,XN) *Grus americana*[1,3]
Wood stork (T) *Mycteria americana*
REPTILES
American alligator (SAT) *Alligator mississippiensis*[2]
American crocodile (T) *Crocodylus acutus*[1]
Blue-tailed mole skink (T) *Plestiodon egregious lividus*
Eastern diamondback rattlesnake (Pet) *Crotalus adamanteus*[2]
Eastern indigo snake (T) *Drymarchon couperi*
Gopher tortoise (C) *Gopherus polyphemus*[2]
Sand skink (T) *Plestiodon reynoldis*
Striped newt (C) *Notophthalmus perstriatus*[2]

Species
INSECTS
Highlands tiger beetle (PE) *Cicindela highlandensis*[2]
PLANTS
Avon Park harebells (E) *Crotalaria avonensis*
Britton's beargrass (E) *Nolina brittoniana*
Carter's mustard (E) *Warea carteri*
Clasping warea/Wide-leaf warea (E) *Warea amplexifolia*
Florida Bonamia (T) *Bonamia grandiflora*
Florida jointweed/wireweed (E) *Polygonella basiramia*
Florida ziziphus/Florida Jujube (E) *Ziziphus celata*
Four-petal pawpaw (E) *Asimina tetramera*
Fragrant prickly apple (E) *Harrisia fragrans/Cereus eriophorus var. fragrans*[1]
Highlands scrub hypericum (E) *Hypericum cumulicola*
Lakela's mint (E) *Dicerandra immaculate*
Lewton's polygala (E) *Polygala lewtonii*
Papery whitlow-wort (Paper nailwort) (T) *Paronychia chartacea*
Perforate reindeer lichen (E) *Chadonia perforata*
Pygmy fringe-tree (E) *Chionanthus pygmaeus*
Sandlace/Small's jointweed (E) *Polygonella myriophylla*
Scrub-blazing-star/Florida blazing-star (E) *Liartis ohlingerae*
Scrub buckwheat (T) *Eriogonum longifolium*
Scrub lupine (E) *Lupinus aridorum*
Scrub mint (E) *Dicerandra frutescens*
Scrub pigeon wing (T) *Clitoria fragrans*
Scrub plum (E) *Prunus geniculata*
Short-leaved rosemary (E) *Conradina brevifolia*
Tiny polygala (E) *Polygala smallii*[1]

[1] Species was not considered to be effected by this action will not be discussed further in this biological opinion
[2] The species is not currently protected under the Act; therefore, it is not included in this consultation.
[3] Although this species is listed under the Act, the Project occurs within the range of the experimental population, and consultation is only warranted on Federal lands.

This Biological Opinion is based on information provided in the FERC's September 11, 2015, SMP Project Draft Environmental Impact Statement (DEIS), FERC's October 1, 2015, request for formal consultation, FERC's December 01, 2015, Final EIS and biological assessment, and other communications, meetings, phone calls, emails, with FERC and FSC. The consultant for FERC is Merjent, Inc. Environmental Services (Merjent) and the environmental consultant for FSC is Environmental Consulting & Technology, Inc. (ECT). A complete record of this consultation is on file at the Service's South Florida Ecological Services Field Office.

FSC did not received permission from landowners to access approximately 4 percent of the Project area. This consultation does not include an analysis of potential effects to listed species on these unsurveyed/unaccessed lands. Prior to proceeding with any construction activities on those lands, FERC/FSC must conducted appropriate surveys to evaluate the presence of listed species. If the proposed Project may affect any listed species, re-initiation of consultation will be necessary prior to commencement of construction on these lands.

Consultation History

On August 19, 2014, FERC sent a letter to the Service requesting our agency to be a cooperating agency on the EIS for SMP, and on September 18, 2014, the Service provided a letter to FERC declining this request.

On December 15, 2015, FERC notified the Service through email that Transcontinental Gas Pipe Line Company, LLC and Sabal Trail Transmission, LLC recently filed their respective applications with FERC for the Hillabee Expansion Project and Sabal Trail Project, respectively. Together, with the previous FSC Project application, the FERC would begin conducting its formal review of the SMP.

On May 27, 2015, FSC emailed the Service to express that appropriate surveys had been conducted within all the affected areas of the Project. FSC indicated the survey reports would be provided to the Service in June of 2015.

On September 9, 2015, FERC requested consultation with the Service on the Project. FERC requested concurrence with their may affect, but not likely to adversely affect determinations and formal consultation for the species that the Project is likely to adversely affect.

FERC provided the Service with the DEIS and biological assessment for review and comments on September 11, 2015.

On September 11, 2015, the Service commented via email to FSC and FERC that the Service had not received an acknowledgement that their comments relating to ECT's Florida Southeast Connection Federally Listed Species Report were received or taken into consideration while developing the EIS.

On October 8, 2015, the Service notified FERC via email that we had not received all of the information necessary to initiate formal consultation on the Project, and that formal consultation would not begin until we received all of the information, or a statement explaining why that information cannot be made available.

On November 11, 2015, FERC and the Service conducted a telephone meeting to discuss DEIS comments.

On November 15, 2015, FSC emailed the Service with their responses to the Service's comments and questions that we submitted on the FERC docket.

On December 1, 2015, FERC provided the Service with the Final EIS and biological assessment for the Project.

On December 11, 2015, FSC provided the Service with their response to the Service's comments on the Project's DEIS.

On January 14, 2016, the Service met with FERC and FSC at the South Florida Ecological Service's Field Office. During the meeting a number of outstanding items were identified. It was agreed that outstanding information would be submitted by FSC to FERC and the Service.

On January 29, 2016, FSC emailed the Service with FSC's additional information relating to the topics discussed during our January 14, 2016, meeting.

On January 29, 2016, ECT provided the Service with shape-files requested at the January 14, 2016 meeting.

On February 2, 2016, FERC issued the Certificate Order.

On March 17, 2016, FERC emailed the Service requesting that the Service modify the effects determinations for the Project per advisement from the Service.

As of March 17, 2016, the Service had sufficient information to initiate formal consultation on the Project, which was communicated to FERC on May, 6, 2016.

Species not likely to be adversely affected by the proposed action

FERC determined that the proposed Project may affect, but is not likely to adversely 25 species protected under the Act (Table 2.) The text following Table 2 provides justification for the Service's concurrence with FERC's determination.

Table 2. Species for which FERC determined that the proposed Project may affect, but is not likely to adversely.

Species
MAMMALS
Florida bonneted bat
Florida panther
BIRDS
Audubon's crested caracara
Everglade snail kite
Florida grasshopper sparrow
Florida scrub–jay
Red-cockaded woodpecker
Wood stork
REPTILES
Eastern indigo snake
PLANTS
Avon Park harebells
Britton's beargrass
Carter's mustard
Clasping warea/Wide-leaf warea
Florida jointweed/wireweed
Florida ziziphus/Florida jujube
Four-petal pawpaw
Highlands scrub hypericum
Lakela's mint
Perforate reindeer lichen
Pygmy fringe-tree
Scrub-blazing-star/Florida blazing-star

Species
Scrub lupine
Scrub pigeon wing
Scrub plum
Short-leaved rosemary

Florida bonneted bat

The Project transverses the Service's consultation and focal area for the Florida bonneted bat. In 2015 ECT surveyed the portion of the Project that overlaps the Florida bonneted bat focal area for potential roost trees by investigating roosting habitat for cavity trees following guidance from the Service. No visual evidence of Florida bonneted bats was observed in 2015. ECT conducted follow-up Florida bonneted bat roost surveys in 2016 where the potential for the Florida bonneted bat roosts existed (*i.e.*, cavity trees), which consisted of the Project right-of-way and one contractor yard. All cavities were inspected using an endoscope camera with LED lighting on long pole. The camera was flexible and allowed inspection around the entirety of the internal cavity space. No bats or any other animals were found in any of the cavities. ECT's survey conclusion was that no Florida bonneted bats are present within the Project area. Based on these survey findings, the Service concurs with FERC's determination the Project may affect, but not likely to adversely affect the Florida bonneted bat.

Florida panther

The Project does not transverse the Florida Panther Consultation Area or the Panther Focus Area (Primary Zone, Secondary Zone, Dispersal Zone or the Primary Dispersal / Expansion Area). However, there is a potential that a Florida panther could travel through the proposed Project area. The Project will not result in the loss of any Florida panther habitat, which has been identified for recovery of the species, and lands within the right-of-way will be allowed to revegetate to a similar condition to adjacent undisturbed lands. Therefore, the Service concurs with FERC's determination that the Project may affect, but not likely to adversely affect.

Audubon's crested caracara

The Project occurs within the Audubon's crested caracara (caracara) consultation area. During the 2015 surveys season FSC identified two nests outside of but within 985 feet (ft) of the pipeline right-of-way. FSC committed to conduct follow-up surveys in January or February 2016 to determine if these nest sites are still active and identify any potential new nest sites.

To avoid and minimize potential adverse effects of the Project to caracara FSC has committed to the following measures:

1) Prior to construction in the caracara consultation area, FSC will conduct Service approved protocol breeding season caracara nest surveys within areas where their presence has previously been documented during the breeding season.

2) Clearing is anticipated to occur between June and October 2016, which is outside the height of the nesting season (*i.e.,* January - March). If areas all are not cleared prior to subsequent nesting seasons, FSC will conduct additional breeding season caracara nest surveys within areas where their presence was previously documented if all or a portion of that breeding season will coincide with construction activities.

3) Known nest trees will be avoided.

4) FSC will limit the removal of optimal nesting substrate (*i.e.*, cabbage palm trees in excess of 16 ft in height) within caracara habitat to the minimum extent necessary for the installation of the pipeline and future maintenance considerations.

5) If caracara nests are identified within the Project area, FSC will postpone construction activities in the primary nest protection zone (985 ft) around each nest until the young birds have fledged.

6) Any carrion found within active construction areas will be removed to minimize possible vehicle injury to caracaras.

7) FSC will conduct employee and contractor education on identifying caracaras. Employees and contractors will be instructed not to harm or harassing the caracara and to allow individuals to leave an area before construction activities can resume.

8) FSC will avoid the use of chemicals toxic to wildlife, including pesticides, fertilizers, or herbicides.

The Service concurs with FERC's determination that the Project may affect, but not likely to adversely affect the caracara based on FSC's commitment to implement the avoidance and minimization measures described above.

Florida grasshopper sparrow

FSC conducted surveys for Florida grasshopper sparrows (grasshopper sparrow) in 2015, following the Service's recommended Florida Grasshopper Sparrow Survey Protocol (Service 2004a). Survey stations were set in all potential grasshopper sparrow habitat

within the Project area. Three surveys, at least 2-week aparts, were conducted with negative results, indicating that grasshopper sparrows were absent from the Project area. Within the potential grasshopper sparrow habitat the Project right-of-way is lined with power poles and fences. These provide opportunities for raptor perching and make the area within the proposed Project and immediately adjacent unsuitable habitat for grasshopper sparrows. No construction activities will occur more than 100 ft outside of the Project right-of-way within potential grasshopper sparrow habitat. Based on condition of the site and the negative survey results, the Service concurs with FERC's determination that the Project may affect, but is not likely to adversely affect the grasshopper sparrow.

Florida scrub–jay

FSC completed Florida scrub-jay (scrub-jay) surveys for the Project in September 2014, October 2014, and March 2015. Survey protocols followed the Service's Scrub-Jay Survey Guidelines (June 2004b) and were conducted within scrub-jay habitat that was within the Project area, including pipeline right-of- way, access roads, and contractor staging areas. No scrub-jays were documented during those survey efforts.

However, FSC subsequently reported that one adult pair of scrub-jays was observed in early March 2015, in the vicinity of Project mile post (MP) 48.8 during surveys for other wildlife species. This pair was not originally documented when surveys were conducted at this location in October 2014. Follow-up observations conducted biweekly in April and early May 2015 consistently recorded this pair in the same general location (MP 48.6 through 48.9); however, no nesting activity was observed, nor did the scrub-jays exhibit behavioral patterns consistent with territoriality. These scrub-jays were typically visible when observers arrived and did not respond to recorded vocalizations.

The scrub-jay pair was usually observed south of the right-way; however, one or the other would sometimes make flights into the right-of-way to roost or forage. The habitat within the right-of-way is of distinctly different character than the habitat where this pair of birds was usually observed. FSC provided photographs to document the marginal condition of the habitat within the right-of-way. No scrub oaks or other typical scrub vegetation are present in the right-of-way. As such, no scrub habitat will be impacted during clearing of this portion of the Project. Furthermore, post construction conditions will be similar to current existing habitat. As an additional minimization measure, FSC will resurvey this area in the spring 2016 breeding season to determine if the pair is still present and/or nesting. Furthermore, FERC's final EIS requires additional protection for scrub-jays, stating: "FSC should avoid construction within occupied Florida scrub-jay habitat between March 1 and June 30, unless additional surveys confirm that this habitat is unoccupied or FSC receives written confirmation from the Commission (FERC) that construction activities can occur within this timeframe."

Based on the fact that FSC will resurvey this area in the spring 2016 breeding season to determine if the pair is still present and/or nesting, FERC's restrictions on construction within scrub-jay habitat during breeding season, the temporary nature of the construction impacts allowing the birds to continue to use the Project right-of-way immediately following construction, and the marginal quality of the habitat for scrub-jays, the Service concurs with FERC that the Project may affect, but is not likely to adversely affect the scrub-jay.

Everglade snail kite

The Project intersects the Everglade snail kite (snail kite) consultation area between MP 52.3 and 53.7 within Lake Kissimmee marshland. FSC conducted snail kite surveys within potential snail kite habitat in February and March 2015, according to approved Service survey protocols. Snail kites were observed at the southern edge of Lake Kissimmee between MP 52.9 and 53.1. At this location, both a male and a female snail kite were observed on the same day, although at different times, and no interaction was observed between the birds. Behavioral observations of the female bird suggested a potential nest site at MP 52.9 within a cluster of willow trees. Because of difficulty reaching the potential nest site, its presence was not positively confirmed. This potential nest, while located in the Project area, is approximately 1,400 ft from any proposed construction activities.

FERC's EIS establishes avoidance and minimization measures for nesting snail kites. The minimization measures specify "the Service has established guidelines that recommend activities such as pipeline construction not occur within 1,640 ft of an active nest. Prior to construction and if construction activities would occur within the snail kite nesting season, FSC would complete snail kite nest surveys near Lake Kissimmee to determine if active nests occur within 1,640 ft of project work areas. If active nests are found, FSC would postpone construction until young have fledged the nest. FSC also proposes to cross Lake Kissimmee and its adjacent wetland habitat using the HDD (horizontal directional drilling) crossing method, which would avoid impacts on foraging and nesting habitat. To further minimize impacts on the snail kite, FSC would implement its construction and restoration plans and train construction personnel to identify snail kites and prevent kite harassment."

Based on the FERCs required measures in the final EIS stated above, the Service concurs with FERC's determination that the Project may affect, but not likely to adversely affect the snail kite.

Red-cockaded woodpecker

During Project preplanning meetings with the Service, FSC indicated that there was approximately 218 acres of habitat fitting minimal red-cockaded woodpecker (RCW) habitat requirements along the Project right-of-way, and that approximately 18 acres of that habitat was within the Service's consultation area for RCWs.

FSC conducted general reconnaissance of all areas deemed to be suitable habitat for RCWs in September and October 2014. During that effort, biologists evaluated habitat conditions and looked and listened for RCWs. This exercise included approximately 24 total man-hours of observation within potential RCW habitat. No RCW were documented during this effort.

Follow-up nesting cavity surveys were conducted in March 2015. These surveys were conducted specifically to document RCW presence and locate specific nest trees, if present. Approximately 48 total man-hours were spent observing during this survey effort. No RCWs or nest cavities were observed. The Project includes potential foraging habitat for RCWs. Protocol surveys to evaluate the area for foraging were not conducted; however, FSC spent 72 man-hours within the potentially suitable habitat and no RCWs were heard or observed.

Surveys did not document any RCWs using the Project's RCW habitat for foraging or nesting. Consequently, the Service concurs with FERC's determination that the Project may affect, but is not likely to adversely affect RCWs.

Wood stork

The Project will alter wetland habitat within seven core foraging areas (CFAs) for the wood stork (Table 3). CFAs are considered to be the 18.6 miles surrounding a known breeding colony. The Project will temporarily disturb the wetlands within the Project area in order to place the pipe and conduct other construction related activities. This disturbance will make a portion of the currently available foraging habitat unavailable to wood storks. FSC will restore the wetland areas following completion of construction.

FERC's final EIS identifies that wetland restoration can take up to 3 years. Therefore, there is potential for the Project to adversely affect wood storks by decreasing the availability of food until the wetland restoration is complete. The proportion of foraging habitat that will be affected by the Project is a small fraction (less than 1 percent in each CFA) of the foraging habitat available to the wood storks in each of the 6 CFAs (Table 3). Therefore, the reduction in the quantity of wood stork forage from the Project's disturbance to wetlands during the 3 years prior to restoration is not likely to affect the ability of the wood storks in those colonies to feed or breed successfully. Consequently, the Service concurs with FERC's determination that the Project may affect, but is not likely to adversely affect the wood stork.

Table 3. Proportion (percent) of wetland impacts within each wood stork core foraging area (CFA) that will be effected by the Project. The table includes the total number of Army Corps of Engineers (Corps) jurisdictional wetland acres and the number of wetland acres that will be affected by the Project.

Wood Stork CFAs	Total Corps Jurisdictional Wetland Acreage Within Wood Stork CFA	Wetland Acres Effected Within CFA	Percent of Wetlands Effected Within Each Wood Stork CFA
Cypress Lake, CFA Wetlands	158,159.6	70.63	.045 %
Gatorland CFA Wetlands*	149,471.8	51.45	.034 %
Lake Russell CFA Wetlands	256,205.2	72.4	.028 %
Saddlebag Lake CFA Wetlands	235,026.8	55.93	.024 %
Lake Rosalie CFA Wetlands	238,653.2	52.58	.022 %
North Fork CFA Wetlands	100,648.3	31.47	.031 %

*CFA for colony only incorporates a 15 mile buffer instead of 18.6 miles.

Eastern indigo snake

The Project occurs within the range of the Eastern indigo snake (indigo snake) and will disturb habitat potentially occupied by the indigo snake during construction. FSC will implement the *Standard Protection Measures for the Eastern Indigo Snake* (Service 2013). In addition, FSC has committed not to handle any living indigo snakes if they are observed during construction or any other Project related activities. Furthermore, FSC has committed to implement the following measures to avoid and minimize potential adverse effects to indigo snakes.

1) All gopher tortoise burrows, active or inactive, will be evacuated prior to Project activities in the vicinity of the burrow. If an indigo snake is encountered, the snake must be allowed to vacate the area prior to additional site manipulation

in the vicinity. A member of the gopher tortoise excavation team will be authorized by the Florida Fish and Wildlife Conservation Commission (FWC).

2) All holes, cavities, and snake refugia other than gopher tortoise burrows will be inspected each morning before planned site manipulation of a particular area, and, if occupied by an indigo snake, no work will commence until the snake has vacated the vicinity of proposed work.

3) Trench ramps will be installed at regular intervals to provide wildlife exits and place gaps in the temporary trench spoil piles and pipe stringing to allow wildlife to migrate through the construction corridor.

4) FSC will not discharge hydrostatic test water within gopher tortoise burrow areas adjacent to the right-of-way or at federally listed plant locations.

5) During construction and initial site clearing an onsite observer will be used to determine whether existing habitat conditions suggest a reasonable probability of an indigo snake sighting. Periodically during the construction activities, the designated agent will visit the Project area to observe the condition of all posted educational materials and replace as necessary.

6) Environmental inspectors assigned to the FSC Project will halt clearing or construction activities if an indigo snake is found. The indigo snake will be allowed to leave the right-of-way on its own accord.

7) Slow speeds will be posted and enforced for all construction traffic.

8) All construction vehicles will adhere to the limits of designated access corridors. Short-cutting between access roads and the pipeline right-of-way will not be permitted.

The proposed Project will affect more than 25 acres of indigo snake habitat and more than 25 active and inactive gopher tortoise burrows. The majority of this disturbance will occur in a linear fashion along the pipeline right-of-way and along access roads; some additional disturbance will occur in staging areas and other associated infrastructure requirements. In Florida, at Archbold Biological Station, average home range size for indigo snake females was determined to be 46 acres and overlapping male home ranges to be 184 acres (Layne and Steiner 1996). The loss of habitat within the right-of way (stretched over the length of the Project) is not anticipated to remove enough habitat within any individual indigo snake's home range that it would result in the inability of the indigo snake to feed, breed, or shelter. In addition, in most cases this habitat loss will be temporary and the habitat will be restored to its former condition following construction. Although restoration will take time, indigo snakes are habitat generalists, and they will use everything from the pristine uplands and wetlands to highly disturbed residential areas (Bolt 2006). Therefore, indigo snakes are expected to use the Project

immediately following and potentially during construction for foraging and sheltering. Finally, through FSC's implementation of the *Standard Protection Measures for Indigo Snake*, any indigo snake will be allowed to move safely from the construction area.

Based on the above avoidance and minimization measures and the fact that the temporary loss of habitat is expected to be a small portion of any individual indigo snake's home range, the Service anticipates that the Project will not result in any mortality nor is it likely to impair the ability of any indigo snake to successfully feed, breed, or shelter. Consequently, the Service concurs with FERC's determination that the Project may affect, but is not likely to adversely affect the indigo snake.

Plants
The Project occurs within the known range of the 24 plants protected by the Act. Botanical surveys did not identify the 16 plant species listed below within Project area. Although, they were not detected, these plants do have the potential to occur within the action area. Based on the absence of the plants during surveys, FERC determined that the Project may affect, but is not likely to adversely affect these plant species; the Service concurs with this determination.

1) Avon Park harebells
2) Britton's beargrass
3) Carter's mustard
4) Clasping warea/Wide-leaf warea
5) Florida jointweed/wireweed
6) Florida ziziphus/Florida jujube
7) Four-petal pawpaw
8) Highlands scrub hypericum
9) Lakela's mint
10) Perforate reindeer lichen
11) Pygmy fringe-tree
12) Scrub-blazing-star/Florida blazing-star
13) Scrub lupine
14) Scrub pigeon wing
15) Scrub plum
16) Short-leaved rosemary

Summary
The Service concurs that federally listed species (Table 2) discussed above are not likely to be adversely affected by the proposed Project; therefore, they will not be discussed further in this Biological Opinion.

BIOLOGICAL OPINION

DESCRIPTION OF PROPOSED ACTION

The proposed FSC Project is located in Osceola, Polk, Okeechobee, St. Lucie and Martin County, Florida, and consists of pipeline facilities and aboveground facilities including one metering and regulating (M&R) station, mainline valves (MLVs), and pig launchers/receivers. The Project would be constructed in one phase to provide 400 million cubic ft per day (MMcfd) of natural gas to Florida Power and Light's (FPL) existing Martin Plant beginning in May 2017, increasing to 600 MMcfd in May, 2020.

FSC proposes to install about 126.3 miles of natural gas transmission pipeline, consisting of 36-inch diameter pipeline between MP 0.0 and 77.1, and 30-inch-diameter pipeline between MP 77.1 to 126.3. The Project would originate at the northern end at Sabal Trail's Reunion Compressor Station and connects with the Sabal Trail gas pipeline project and extends generally south and southeast across the five counties. The gas pipeline would be operated with a maximum allowable operating pressure (MAOP) of 1,440 pounds per square inch. Figure 1 provides a map with an overview of the Project.

The Project would include the construction of one M&R station and the installation of MLVs along the pipeline route. All of the aboveground facilities would be located within or generally adjacent to FSC's right-of-way or within other aboveground facility boundaries. Other minor, appurtenant facilities may also be installed.

FSC proposes to generally use a 100-ft-wide temporary right-of-way to construct the majority of the proposed route in upland non-agricultural areas and a 125-ft-wide construction right-of-way in agricultural areas. This right-of-way would be reduced as necessary through sensitive areas such as wetlands, waterbodies, residential lands, and some areas containing federally listed species. Constructing this Project would require the temporary use of about 1,378.5 acres of land.

The pipeline route would be collocated with existing roads and utilities for approximately 72.9 miles (58 percent) of the total pipeline length. The remaining 53.4 miles (42 percent) of the pipeline route would deviate from these rights-of-way or corridors.

Following construction, FSC would retain a 50-ft-wide permanent right-of-way to operate the pipeline. The permanent right-of-way would require about 738.7 acres of land. In addition to the construction right-of-way, additional temporary workspaces (ATWS) would be required. Most ATWSs would add 25 ft onto the construction right-of-way, effectively creating a 125- to 155-ft-wide work area at the ATWS location. In total, ATWSs would temporarily require about 168.1 acres of land.

FERC has identified 276 existing roads in their Final EIS that would need to be improved or modified. Additionally, FSC would permanently maintain 10 existing

roads for operations and build 7 new roads for temporary use during construction. After construction, FSC will remove access road improvements and restore improved roads to their preconstruction condition unless the landowner or land-managing agency requests that the improvements be left in place. At the time of the Final EIS publication FERC was not aware of any landowners or land-managing agencies that have requested FSC leave road improvements in place.

FSC would design, construct, operate, and maintain their pipeline and facilities in accordance with U.S. Department of Transportation (DOT) regulations under 49 CFR 192 (Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards) and other applicable federal and state regulations. DOT regulations specify pipeline material selection; minimum design requirements; protection from internal, external, and atmospheric corrosion; and qualification procedures for welders and operations personnel, in addition to other design standards. FSC would also comply with the siting and maintenance requirements under 18 CFR 380.15 (Siting and Maintenance Requirements) and other applicable federal and state regulations, including the requirements of the U.S. Department of Labor, Occupational Safety and Health Administration. These safety regulations are intended to ensure adequate protection of the public, pipeline workers, contractors, and employees, and to prevent natural gas pipeline accidents and failures.

For additional details relating to the description of the proposed action, please refer to the FERC SMP Project Final EIS, Docket Nos. CP14-554-000, CP15-16-000, and CP15-17-000 FERC/EIS-0262F, December 2015.

Minimization Measures
FSC has committed to implement the following measures to avoid and minimize the potential adverse effects of the Project with a focus on skinks and listed plants.

1) All populations of skink and federally listed plant species within the right-of-way will be marked in the field and located on construction drawings and avoided where possible.

2) To offset temporary habitat impacts and potential injury and harm to skinks, FSC will purchase credits from a Service approved sand skink conservation bank prior to initiation of construction in known or presumed occupied sand skink habitat. Based on discussion with Service staff, FSC will purchase 5.61 acre-credits for the proposed temporary impacts on the 74.21 acres of occupied skink habitat. The Service used a Habitat Equivalency Analysis (HEA; NOAA 2006) to determine the appropriate amount of mitigation. The HEA assumes the disturbance and the on-site restoration will occur within the same year (12 months).

3) The top 6 inches of topsoil ("A" soil horizon) over the permanently impacted trench line at the 16 occupied (known or presumed) skink habitat sites will be removed and placed immediately adjacent to edge of the right-of-way. The remaining trench spoil will be stockpiled immediately adjacent to the segregated topsoil. Following pipeline

installation, the soils will be backfill, and the 6 inches of segregated topsoil will be returned as the final top soil layer.

4) All areas within known or presumed occupied skink habitat will be allowed to re-vegetate by natural recruitment. Planting or seeding with sod-forming grasses or exotics will not be allowed within skink habitats.

5) Within skink habitats, clearing of un-trenched habitats will be performed using vegetation mulching equipment to minimize soil disturbance and allow for re-sprouting of native vegetation.

6) Mulch and hydrostatic test water discharge will not be allowed in occupied or presumed to be occupied skink habitats.

7) Construction vehicles will adhere to the limits of designated access corridors. Short-cutting between access roads and the pipeline right-of-way will not be permitted.
8) Post-construction vegetation maintenance of the 50-ft permanent right-of-way will be limited to mowing once every three years, if required, between the months of August and February when skinks are less active. However, to facilitate periodic corrosion/leak surveys, a corridor not exceeding 10 ft in width centered on the pipeline may be cleared at a frequency to maintain that 10-ft corridor in an herbaceous state. In addition, trees within 15 ft of the pipeline with roots that could compromise the integrity of the pipeline coating may be selectively cut and removed from the permanent right-of-way.

9) Vegetation mowing or clearing will be prohibited during the bird nesting season (March 1 to August 31 in Florida).

10) Preconstruction topography in uplands, wetlands, and water bodies will be restored to the greatest extent practicable.

11) Where possible, pipeline facilities will be collocated within the FSC gas pipeline right-of way to minimize vegetation clearing and habitat fragmentation.

12) Construction and operational right-of-way widths will be limited to the minimum necessary for the gas pipeline construction.

13) Trench ramps will be installed at regular intervals to provide wildlife exits and place gaps in the temporary trench spoil piles and pipe stringing to allow wildlife to migrate through the construction corridor.

14) An invasive species management plan will be implemented to minimize and control the spread of noxious and invasive species.

15) Equipment used in areas containing invasive plant species will be cleaned before moving to an un-infested area to prevent the spread of invasive plant species seeds, roots, or other viable plant materials.

16) The pipeline clearing and construction footprint within federally listed plant habitat will be reduced (*i.e.*, necked-in) to the minimum width required for installation of the gas pipeline. Where necking-in is implemented, signs indicating an "Environmental Sensitive Area" will be placed along the safety fence.

17) Where avoidance of federally listed plants through "necking-in" is determined not be a feasible option, federally listed plants within that portion of right-of-way will be identified and temporarily relocated to an adjacent portion of the right-of-way that can be avoided. Plants may be relocated to a suitable location adjacent to the right-of-way with landowner's permission. Once final restoration of the ground surface has been completed, these plants will be returned to as close as possible to their original location. Insofar as these small, herbaceous plants may not be ideal for transplanting, this alternative is secondary to necking in.

18) Within federally listed plant habitat, typical vegetative restoration measures such as sodding, seeding, and fertilizing will not be allowed. The affected listed plants are adapted to open, sandy, and relatively sterile soils.

19) Safety fencing will be placed along the edge of the construction right-of-way to separate the federally listed plant species habitat that occurs in the construction work area from the existing plant populations found within the adjacent land (outside of the right-of-way) prior to commencing construction activities to reduce disturbance to existing populations.

20) If no other avoidance or minimization option is deemed feasible, FSC will coordinate with the Service, Florida Department of Agriculture & Consumer Services, individual landowners, and other potentially interested parties (*e.g.*, Bok Tower Gardens Rare Plant Conservation Program) to investigate feasibility of relocating some listed plant species to other protected lands (offsite) or using available rare plant seed bank resources (if any) to re-vegetate the right-of way. If FSC proceeds with relocating some plants to protected lands off-site a 10(a)(1)(A) permit may be necessary and FERC and FSC will contact the Service to evaluate whether re-initiation is warranted.

Action Area

The action area is defined as all areas to be affected directly or indirectly by the action, not merely the immediate FSC Project gas pipeline right-of-way. In addition to the gas pipeline right-of-way the Service has identified the action area to include: all construction areas, staging areas, discharge and stockpile areas, and access road corridors.

STATUS OF THE SPECIES/CRITICAL HABITAT

Blue-tailed mole skink
Please see Enclosure A for the Status of the Species of the blue-tailed mole skink (December 2015).

Sand skink
Please see Enclosure B for the Status of the Species of the sand skink (January 2016).

Florida bonamia
Please see Enclosure C for the Status of the Species of the Florida bonamia (July 2010).

Lewton's polygala
Please see Enclosure D for the Status of the Species of the Lewton's polygala (October 2010).

Papery whitlow-wort
Please see Enclosure E for the Status of the Species for the papery whitlow-wort (October 2010).

Sandlace
Please see Enclosure F for the Status of the Species for the sandlace (October 2010).
Scrub buckwheat
Please see Enclosure G for the Status of the Species for the scrub buckwheat (July 2010).

Scrub mint
Please see Enclosure H for the Status of the Species for the scrub mint (May 2015).

Critical habitat has not been designated for any of the species listed above; therefore, critical habitat will not be affected by the proposed Project and will not be discussed further within this biological opinion.

ENVIRONMENTAL BASELINE

Status of the species within the action area

Blue-tailed mole skink and sand skink

Skink soils typically support scrub, sandhill, or xeric hammock natural ecological communities, such as oak-dominated scrub, turkey oak (*Quercus laevis*) barrens, high pine, and xeric hammocks. Typical upland habitat for both blue-tailed mole skinks and sand skinks consists of sand pine (*Pinus clausa*)-rosemary (*Ceratiola ericoides*) scrub or longleaf pine (*Pinus palustris*)-turkey oak association. Sand skinks have also been documented in skink soils where natural vegetative cover has been altered for human uses such as pine plantations, active or inactive citrus groves, pastures, and residential developments, as well as neglected vegetative cover like old fields and overgrown scrub (Pike *et al.* 2008). Consequently, habitat condition or vegetative cover alone cannot be used to exclude areas that might be used by the skinks.

Both skinks typically occur in areas that contain a mosaic of open sandy patches interspersed with forbs, shrubs, and trees. Sand skink tracks are usually observed in open sandy areas, yet both skink species use a variety of micro-habitats within xeric vegetative communities. Sand skink tracks appear most abundant in the ecotone, or edges, between

areas with abundant leaf litter and vegetative cover and adjacent open sands. Blue-tailed mole skinks are typically found under leaf litter, logs, palmetto fronds, and other ground debris (Christman 1992).

FSC identified a total of 222 acres of potentially suitable habitat for the skinks within FSC's action area. Blue-tailed mole skinks have not been located on-site; however, this species is usually found in habitats occupied by sand skinks in Polk, Highlands, and Osceola Counties, and a reliable survey technique to detect blue-tailed mole skinks is not currently available. Therefore, presence of sand skinks is used as an indicator that blue-tailed mole skinks are likely also present.

Skinks were not directly observed during general wildlife and habitat surveys in 2014 and 2015; however, the characteristic sinusoidal tracks of sand skinks were detected at 16 locations between MP 2.5 and 35.8 (Table 4). FSC conducted cover board surveys in 2015 at locations requested by the Service to evaluate skink presence and to identify additional areas that may be occupied by skinks. Cover board surveys were conducted in suitable skink habitats. No skinks or skink tracks were identified during cover board surveys. Based on the results of the cover board surveys, the observations of skink tracks, and the assumption of skink presence in some areas, the current configuration of FSC's construction workspaces for the proposed Project will affect 74.2 acres of habitat considered to be occupied by skinks.

Table 4. Locations of skink tracks observed along the FSC Project right-of-way between September 2014 and May 2015. Table Source: FSC Project, Osceola, Polk, St Lucie, Okeechobee and Martin counties, Florida, Federally Listed Species Report, July 2015.

Track Locations (Known Presence)	Approximate Mileposts	Habitat	Number Tracks Observed	Acreage
1	2.4 to 2.5	Turkey oak sandhill	1	0.96
2	2.9 to 3.3	Xeric oak scrub	10	4.18
3	5.0 to 5.3	Xeric oak scrub	1	2.39
4	6.8 to 7.2	Xeric oak scrub	4	4.14
5	8.6 to 9.1	Xeric oak scrub	2	5.7
6	11.7 to 11.9	Turkey oak sandhill	3	2.11
7	14.1 to 14.8	Pasture (sparse grassland)	1	8.71
8	16.6 to 16.8	Active citrus	1	2.9
9	19.9 to 20.0	Active citrus	1	1.66
10	24.4 to 24.9	Active citrus	3	5.86
11	25.4 to 26.7	Pasture (sparse grassland)	5	15.27

12	27.2 to 27.3	Active citrus	2	1.52
13	28.2 to 28.8	Xeric oak scrub	3	1.13
14	31.3 to 31.4	Sparse grassland	3	1.41
15	35.5 to 35.7	Sand pine scrub	2	2.14
16	35.7 to 35.8	Sparse Grassland	1	0.99

Track locations 1-6, 11, and 13-15 (highlighted) are proposed for post construction monitoring by FSC.

Florida bonamia

Florida bonamia is endemic to the Florida peninsula and is typically found in sand pine scrub consisting of evergreen scrub oak and sand pine with openings between the trees and shrubs occupied by lichens and herbs. The species generally requires an open canopy in full sunlight in order to avoid competition from the surrounding shrubs, and prefers white, acidic sands. Either natural fires or prescribed burns are necessary to maintain habitat in natural scrub ecosystems. The Florida bonamia is also known to live in disturbed areas near roadways and clearings caused by logging operations. FSC completed surveys for the Florida bonamia between September 22 and October 15, 2014. Two Florida bonamia plants were documented at one location near the edge of the pipeline corridor near MP 9.0.

Lewton's polygala

Lewton's polygala is endemic to the Lake Wales and Mount Dora Ridges of Highlands, Polk, Osceola, Orange, Lake, and Marion Counties, Florida. It is found in oak scrub and high pine, but is more common in the transitional areas between these two community types. The species is found in sunny openings and often colonizes disturbed sites, such as roadsides and fire lanes. Either natural fires or prescribed burns are necessary to maintain habitat in natural scrub ecosystems. FSC completed surveys for Lewton's polygala in spring 2015. One plant was documented near MP 8.9.

Papery whitlow-wort

Papery whitlow-wort is endemic to the Lake Wales Ridge scrub of Highlands, Polk, Osceola, Orange, and Lake Counties, Florida. It is found in rosemary scrub or the rosemary phase of sand pine scrub communities where it colonizes disturbed, open, sandy sites. It prefers the well-drained, white sands of the St. Lucie or Archbold soil types (Service 1999). FSC completed surveys for the papery whitlow-wort between September 22 and October 15, 2014. Five groups of papery whitlow-wort were documented along the pipeline corridor between MPs 8.0 and 35.6. The groups ranged in abundance from 1 to 25 individuals documented. A total of 66 papery whitlow-wort plants were documented during surveys.

Sandlace

Sandlace is endemic to the Lake Wales Ridge of Highlands, Polk, Osceola, and Orange Counties, Florida. It is a low, spreading shrub that prefers moderately disturbed areas of bare white or yellow sand. FSC completed surveys for sandlace in spring 2015. Approximately 10 individuals of this species were documented at one location near MP 35.5.

Scrub buckwheat

Scrub buckwheat occurs in high pine and turkey oak barren habitats in Marion, Pasco, Hillsborough, Lake, Orange, Osceola, Highlands, and Polk Counties, Florida. FSC completed surveys for the scrub buckwheat between September 22 and October 15, 2014. A few isolated patches, with a total of approximately 50 individual scrub buckwheat plants, were documented by FSC within the pipeline corridor between MPs 8.8 and 9.0.

Scrub mint

Scrub mint inhabits the southern portion of the Lake Wales Ridge in Highlands County. Its preferred habitat is excessively drained, yellow sandy soils of the Astatula and Paola soil types, but has also been found on a moderately well-drained, yellow sand of the Orsino type. In these soil types, the scrub mint occurs adjacent to or within disturbed areas in sand pine scrub, oak scrub, and sandhill habitats with shallow litter layers that have an incomplete, or non-existent, tree and shrub canopy (Menges 1992). At present, scrub mint is known from 14 populations in Polk and Highlands County (FNAI 2015). FSC completed surveys for the scrub mint between September 22 and October 15, 2014. The scrub mint was documented at several locations within the pipeline corridor between MPs 8.4 and 9.0. Approximately 160 individual scrub mints were document during surveys.

Factors affecting species environment within the action area

The habitats surrounding the action area are threatened by degradation resulting from active agriculture (cattle ranching, citrus, row crops, and sod), sand mining, fire exclusion, lack of management, and residential/transportation development. Suitable species habitat is interspersed within the residential and compacted pastureland. Xeric habitats require periodic fire to maintain optimal habitat values such as patches of bare sand and low shrub architecture. Over time, the need to protect agricultural, residential, and commercial development has resulted in the suppression of wildfires, degrading the quality of the interspersed species habitat. Xeric habitats lacking periodic fire or management become overgrown and less suitable to the species addressed herein.

Blue-tailed mole skink and sand skink

The modification and destruction of xeric upland communities in central Florida were a primary consideration in listing the sand skink as threatened. Xeric uplands remaining on private lands are especially vulnerable to destruction because of increasing residential and agricultural pressures.

Improper habitat management and invasion by nonnative and invasive species are additional threats to skinks. Active management is necessary to maintain suitable habitat for skinks. Management of scrub habitat is problematic because much of the remaining habitat occurs in small fragmented areas surrounded by residential areas where prescribed burning may not be feasible. Either natural fires or prescribed burns are necessary to maintain suitable skink habitat within the natural scrub ecosystems. Within the action area fire may be reduced or completely eliminated because of increased emphasis on fire control programs. In addition, residential areas are also often a source of nonnative plants that invade native habitat.

Habitat degradation on protected and private sites continues to be a threat because vegetation restoration and management programs are costly and depend upon availability of funding. Where prescribed fire is not feasible as a management technique because of smoke management and other concerns, mechanical treatment is sometimes used. However, heavy machinery disturbs the soil more than prescribed burning, and it removes often limited nutrients from the soil (Mushinsky *et al.* 2001). This changes the nutrient levels in the topsoil, affecting the vegetative composition of the site, whereas fire releases nutrients (Mushinsky *et al.* 2001). Also, if logs are removed from a site after mechanical treatment, prey abundance (termites) may be lower than it would be after a fire (Mushinsky *et al.* 2001).

Florida bonamia

Florida bonamia depends on the sunny cleared areas left by periodic fires or physical disturbance (Service 52 FR 42068). Reduced fire frequency has left many of the scrub sites overgrown and unsuitable for highly specialized scrub endemics that require open sunny patches. Roadsides and rights-of-way are often the only available openings, and therefore, are used by the species. Roadsides and rights-of-way can be filled with invasive exotics that compete with scrub endemics. In addition, road maintenance and right-of-way activities such as mowing, herbicide spraying, and soil disturbance can adversely affect native species.

Lewton's polygala

Habitat loss has played a large role in the current abundance and distribution of Lewton's polygala. The loss and fragmentation of habitat has resulted in scattered, mostly small, populations. In addition, Lewton's polygala may respond poorly to a reduction in fire frequencies. Roadsides and rights-of-way provide habitat openings used by the species. However, roadsides and rights-of-way can be filled with invasive exotics that compete with scrub endemics. In addition, road maintenance and right-of-way activities such as mowing, herbicide spraying, and soil disturbance can adversely affect native species.

Papery whitlow-wort

The density of papery whitlow-wort increases in relation to available open space (Hawkes and Menges 1996; Menges and Kohfeldt 1995), so the species is most abundant in disturbed, sandy areas such as road rights-of-way and recently cleared high pine (Abrahamson *et al.* 1984; Christman 1988; Service 1996). Fire frequency is an important means for maintaining open spaces in scrub habitat. Johnson and Abrahamson (1990) and Ostertag and Menges (1994) found that papery whitlow-wort appeared in rosemary balds after fires, even though it had been rare or absent prior to the burn. This strongly indicates that papery whitlow-wort maintains seed banks in the soil, waiting for suitable germination conditions. Reduction in fire frequencies therefore, is likely contributing to further decline of the species. Although roadsides and rights-of way provide the benefit of open spaces for this species, they are often filled with invasive exotics that compete with scrub endemics. In addition, road maintenance and right-of-way activities such as mowing, herbicide spraying, and soil disturbance can adversely affect native species.

Sandlace

Sandlace occupies open, sandy areas within the scrub vegetation and appears to require fire or other disturbances that create or maintain these sandy gaps. Reduction in fire frequencies therefore, is likely contributing to a further decline of the species. Roadsides and rights-of-way provide sandy gaps and openings, and therefore, are used by the species. However, roadsides and rights-of-way can be filled with invasive exotics that compete with scrub endemics. In addition, road maintenance and right-of-way activities such as mowing, herbicide spraying, and soil disturbance can adversely affect native species.

Scrub buckwheat

One of the principal causes of decline of scrub buckwheat is the conversion of high pineland and scrub for commercial use. Abrupt changes in partial shade and/or soil moisture resulting from clearing activities may affect plant survival. Prescribed burning is the "most appropriate treatment for enhancing both seed production and seedling recruitment, and linking the two in time" (McConnell and Menges 2002). This species tolerates a wide variety of fire intervals, prescribed fire regimes do not have to be tailored to its specific needs; however a reduction in fire frequency has resulted in a decline of this species. Fire intensity and frequency are also limiting factors lessoning scrub buckwheat chances for survival.

Scrub mint

The known range of the scrub mint is quite small. Loss of habitat as well as fire suppression in tracts of remaining habitat, are the principle threats to scrub mint. Although scrub mint occurs on roadsides and rights-of-way, these areas can be filled with invasive exotics that compete with scrub endemics. In addition, road maintenance and right-of-way activities such as mowing, herbicide spraying, and soil disturbance can adversely affect native species.

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). Detailed explanations of global climate change and examples of various observed and projected changes and associated effects and risks at the global level are provided in reports issued by the IPCC (2014 and citations therein). Information for the United States at national and regional levels is summarized in the National Climate Assessment (Melillo *et al.* 2014 entire and citations therein; see Melillo *et al.* 2014, pp.28-45 for an overview). 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 and have been developed through appropriate scientific procedures, because such projections provide higher resolution information that is more relevant to spatial scales used for analyses of a given species and the conditions influencing it. (See Melillo *et al.* 2014, Appendix 3, pp. 760-763 for a discussion of climate modeling, including downscaling). 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.

Climate change may result in an increase in the intensity or frequency of tropical storms and hurricanes in Florida. The Atlantic Multi-decadal Oscillation also influences rain patterns in Florida. The increased rainfall associated with both of these factors could reduce our ability to effectively use prescribed burning to manage habitat in optimal conditions for skinks as well as federally listed scrub endemic plants.

It is difficult to estimate, with any degree of precision, if a 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.

For the skinks and federally listed plants increases in storm frequency and sea level rise will likely have natural/biological effects, such as reduction in available habitat (destruction during storms and inundation from sea level rise), and decreased reproduction success. In addition, sea level rise is likely to increase man-made effects, as the human population moves from the coast to central parts of the State. This human migration will increase the demand for development and could lead to increased loss of scrub habitat. In addition, the increased human population would likely increase the threats associated with human interactions such as fire suppression, and competition with non-native species.

EFFECTS OF THE ACTION

Factors to be considered

Duration

The majority of effects of a proposed Project on federally listed species habitats have been identified as a temporary. The Project's final EIS describes the action as "A short-term impact ..". FSC will prepare the right-of-way, trench for the pipeline, and then restore the right-of-way. Following construction, FSC will retain a 50-ft-wide permanent right-of-way to operate the pipeline; however, annual activities will be centered within 10 ft above the line. Although effects to the habitat will be mostly temporary, the adverse effects to some individuals will be a permanent.

Disturbance frequency

Although construction will be a single event, as specified in the FSC's construction and restoration plans, vegetation maintenance activities will be conducted for the ongoing operation of the pipeline. Vegetation maintenance may be conducted annually over the 10-ft-wide corridor centered over the pipeline, and vegetation clearing may occur every 3 years within the 50-ft-wide permanent right-of-way in non-riparian areas, depending on regrowth. FSC will maintain a 30-ft-wide pipeline right-of-way in forested wetland areas. These clearing activities will prevent the establishment of larger woody species within the maintained pipeline right-of-way. The frequent removal of shrub and forested vegetation from operation of the Project facilities could result in habitat fragmentation, loss of wildlife habitat, loss of natural noise barriers/buffers.

Analyses for effects of the action

Blue-tailed mole skink and sand skink

Direct effects

Skinks (adults, immature, and eggs) present within the construction workspaces or within areas that are maintained during operation of the pipeline could be injured or killed by construction activities, such as vegetation clearing and removal, debris piling (soil stock piling), trenching, entombing during soil movement, and operation of equipment traffic along the right-of-way and access roads. These activities can crush or injure individual skinks and skink eggs and destroy or degrade occupied habitat including foraging areas.

In addition, any clearing activities have the potential to adversely affect skinks by causing them to leave the area and possibly miss foraging and mating opportunities. Individual skinks fleeing the area may be more vulnerable to predation. During restoration of the Project site, soil will be replaced and regraded within the right-of way. If the unsuitable soil is mixed or used in this process it could render the habitat unsuitable for skinks or create a barrier to movement.

Indirect effects

Potential indirect effects of the Project on skinks include further habitat degradation due to increased fire suppression or infestation from invasive plant species, and habitat fragmentation.

The proposed Project could increase the level of fire suppression, within the scrub habitat because of the additional development. However, FSC will only retain a 50-ft right-of-way, and ownership and land management of the remaining acreage will remain with the current land owner. Therefore, land management practices are not likely to change from their current use, and although the habitat is already fire suppressed, the Project is not likely to contribute further to this condition.

The initial clearing, as well as ongoing mowing and vegetation maintenance within the 50-ft right-of-way could provide opportunities for invasive plants to increase in abundance and degrade skink habitat. FSC has committed to implement an invasive species management plan to minimize and control the spread of noxious and invasive species. Consequently, habitat degradation from invasive plant species is unlikely to occur.

We do not anticipate that the Project will increase fragmentation of skink habitat because the habitat loss is expected to be temporary and skinks are expected to return to the construction area.

Beneficial Effects

No beneficial effects from the Project are anticipated for the blue-tailed mole skink or sand skink.

Florida bonamia, Lewton's polygala, papery whitlow-wort, sandlace, scrub buckwheat, and scrub mint

Direct effects

Clearing and construction activities for the Project have the potential to injure and kill (crush) Florida bonamia, Lewton's polygala, papery whitlow-wort, sandlace, scrub buckwheat, and scrub mint that were documented in the Project area. In addition, trenching and the compaction of the soil have the potential to damage the seed bank for these species. FSC will restore the area within the construction right-of-way; therefore, the adverse effects to the habitat will be temporary. On-going mowing and maintenance within the right-of-way will likely injure individual plants that survive or re-establish and could possibly kill plants depending on the extent of damage during mowing.

Indirect effects

Potential indirect effects of the Project on Florida bonamia, Lewton's polygala, papery whitlow-wort, sandlace, scrub buckwheat, and scrub mint include further habitat degradation due to increased fire suppression or infestation from invasive plant species, and habitat fragmentation.

The proposed Project could increase the level of fire suppression, within the scrub habitat because of the additional development. However, FSC will only retain a 50-ft right-of-way, and ownership and land management of the remaining acreage will remain with the current land owner. Therefore, land management practices are not likely to change from their current use, and although the habitat is already fire suppressed, the Project is not likely to contribute further to this condition.

The initial clearing, as well as ongoing mowing and vegetation maintenance within the 50-ft right-of-way could provide opportunities for invasive plants to increase in abundance and out-compete listed plants. However, the listed scrub plants favor disturbance and are characterized by opportunistically taking advantage of open spaces created by disturbance. The probably of spreading invasive species will increase as a result of the Project's construction and maintenance equipment moving in and out of the proposed Project action area. FSC will minimize the likelihood of spreading invasive plant species during construction by cleaning the equipment used in areas containing invasive plant species before moving to an un-infested area. Finally, FSC has committed to implement an invasive species management plan to minimize and control the spread of noxious and invasive species. Consequently, habitat degradation from invasive plant species is unlikely to occur.

Habitat fragmentation is not anticipated to adversely affect the listed plants because FSC will restore the area within the construction right-of-way.

Beneficial Effects

There is some possibility that the six federally listed plants (Florida bonamia, Lewton's polygala, papery whitlow-wort, sandlace, scrub buckwheat, and scrub mint) may benefit from the disturbance of construction because it will increase the open spaces along the right-of-way; providing opportunities for the listed plants, which favor open spaces, to establish. In addition, ongoing vegetation maintenance and mowing could continue to provide opportunities for open spaces interspersed within the scrub habitat and provide disturbance in the fire suppressed habitat. The continued disturbance and availability of open spaces could support continued recruitment of Florida bonamia, Lewton's polygala, papery whitlow-wort, sandlace, scrub buckwheat, and scrub mint.

Species' response to the proposed action

Blue-tailed mole skink and sand skink

In order to minimize the effects of the Project on skinks, FSC has committed to a number of measures including but not limited to: avoiding areas where skinks are known to occur where possible, conducting clearing using vegetation mulching equipment to minimize soil disturbance, and allowing for re-sprouting of native vegetation. In addition, to minimize soil compaction and potential crushing, construction vehicles will adhere to the limits of designated access corridors. To minimize the likelihood that the trench will create a barier to skink movement, FSC will collect the top 6 inches of soil over the trench line and place it immediately adjacent to the edge of the right-of-way. Following pipeline installation, the soils will be backfilled, and the 6 inches of segregated topsoil will be returned as the final top soil layer. To minimize the onging disturbance to skinks and their habitat during maintenance, post-construction vegetation maintenance of the 50-ft permanent right-of-way will be limited to mowing once every three years, if required, between the months of August and February when skinks are less active.

The construction of the Project will result in the temporary degradation/destruction of 74.2 acres of habitat considered to be occupied by skinks. Skinks (adults, immature, and eggs) present during construction within the 74.2 acres will likely be injured or killed from construction activities including land clearing, debris piling, crushing from vehicles, and/or entombing during earth moving, contouring and trenching. Some portion of skinks may respond to the construction activities by attempting to flee the Project site to avoid the disturbance. However, because skinks are not highly agile, they are not likely to be able to successfully flee the Project site before they are affected by construction activities. Regardless, a small fraction may escape and move to the adjacent habitat. Individuals that escape mortality within the construction area could be adversely affected by missing foraging and/or mating opportunities or could be killed because they are more vulnerable to predation. Consequently, any and all skinks that inhabit the 74.2 acres of occupied skink habitat are expected to be taken in the form of harassment, injury, and/or mortality.

Impacts to the habitat are considered permanent only when all vegetation is permanently destroyed. Because FSC will restore the habitat, replacing the top 6 inches of soil in the trench, and allow the vegetation to naturally restore, the effects to the habitat are considered temporary; and skinks are expected to reoccupy the habitat. Based on FERC's restoration monitoring efforts along previous pipeline rights-of way, restoring the temporary construction areas to forest habitats could take 30 years or longer. The impacts on shrub-dwelling species would be comparable to impacts on forest dwelling species due to lengthy regeneration timeframes of these habitats (FERC 2016). The habitat's vegetation does not need to be completely restored in order for skinks to begin using the swimmable soils in the right-of-way. We anticipate that prey food and skinks will return much more quickly than the 30 years or more that it could take for the habitat to regenerate to pre-construction conditions. We anticipate that skinks could begin moving back into the right-of-way within the first year, and based on the lifecycle of the skink

(3-4 years), we anticipate that skinks will reestablish a breeding population within two lifecycles or within approximately 8 years.

The ongoing maintenance mowing (estimated to be every 3 years within the 50 ft right-of-way and annually in the 10-ft right of way) has the potential to adversely affect skinks by crushing them and disturbing habitat. Because skinks are a fossorial species, we anticipate that skinks will avoid mortality by taking refuge within the soils. The infrequent mowing operations are not expected to result in compaction of the soils, which would render them unsuitable for skinks. Finally, there is some potential, although low, that the regular mowing could benefit skinks by providing open spaces, a surrogate disturbance for fire.

Turner *et al.* (2006) reported that blue-tailed mole skinks are known to occur in 23 locations, 22 of which are on the Lake Wales Ridge. The subspecies has not been documented elsewhere off of the Lake Wales Ridge and is believed to be restricted to this ridge alone (Moler 2007; Mushinsky 2007). Unfortunately, determining population stability and viability for blue-tailed mole skink is unattainable with current information. Because of the ongoing habitat loss and degradation on the Lake Wales Ridge, it is likely that overall populations are declining (Moler 2007). However, it appears that skinks are still distributed throughout their historic range. Although the range wide population of blue-tailed mole skinks is unknown, the loss of the individual blue-tailed mole skinks (adult, immature, eggs) from the Project during construction and land clearing within the 74.2 acres of occupied skink habitat is expected to be a fraction of the total population within the 23 known locations. Because the Project will only temporarily degrade/remove skink habitat, the Project is not expected to reduce the range of the species; and blue-tailed mole skinks are expected to reoccupy the right-of-way and establish a breeding population within two lifecycles (approximately 8 years) following construction.

The sand skink occurs on the sandy ridges of interior central Florida with principal populations occur on the Lake Wales Ridge and Winter Haven Ridges in Highlands, Lake, and Polk Counties (Christman 1992; Mushinsky and McCoy 1991). Although we do not have estimates of acreage for all of the ridges, we do know the largest of these, the Lake Wales Ridge, encompasses approximately 517,303 acres (Weekley *et al.* 2008). According to the Florida Natural Areas Inventory (FNAI) database, updated as of September 2006, there were 132 locality records for the sand skink, including 115 localities on the Lake Wales Ridge, 7 on the Mount Dora Ridge, and 4 on the Winter Haven Ridge (Griffin 2007). FNAI also reports four localities for this species west of the Mount Dora Ridge in Lake County and two localities between the Lake Wales Ridge and the Lake Hendry Ridge. Similar to blue-tailed mole skinks, although the range wide population of sand skinks is unknown, based on the acreage of occupied skink habitat across the range and the number of locality records, the loss of the individual sand skinks (adult, immature, eggs) during construction and land clearing within the 74.2 acres of occupied skink habitat is expected to be a small fraction of the total population. Again, because the Project will only temporarily degrade/remove skink habitat, the Project is not expected to reduce the range of the species; and sand skinks are expected to reoccupy the right-of-way and establish a breeding population within two lifecycles (approximately 8 years) following construction.

Conservation of skinks

To offset the temporary loss of skink habitat for both blue-tailed mole skink and sand skink, FSC will purchase 5.61 acre-credits from a Service approved sand skink conservation bank prior to initiation of construction in skink habitat. This acreage was established using a HEA, which assumed disturbance and the on-site restoration will occur within the same year (12 months), and that the skinks would reoccupy the habitat within 8 years.

Florida bonamia, Lewton's polygala, papery whitlow- wort, sandlace, scrub buckwheat, and scrub mint

FSC will implement several avoidance and minimization measures (Minimization Measures 14 – 20) to reduce adverse effects to listed plants and reduce the number of individual plants that will be destroyed or killed during construction of the pipeline, these include: reducing the pipeline clearing and construction footprint within federally listed plant habitat to the minimum width required for installation of the gas pipeline, and where avoidance of federally listed plants within that portion of right-of-way cannot be accomplished individual plants will be identified and temporarily relocated to an adjacent portion of the right-of-way.

In addition, the equipment used in areas containing invasive plant species will be cleaned before moving to an un-infested area to prevent the spread of invasive plant species and an invasive species management plan will minimize and control the spread of noxious and invasive weeds so that they will not adversely affect and out compete native species, including the federally listed plants.

FERC's final EIS echoed these minimization measures for the listed plant species, and requires FSC to: 1) conduct "temporary" removal of plants and soil profile plugs (which include the A and B horizons) with the intent to replace to original location post construction; and 2) implement transplanting and seed banking (after all other options are considered).

Regardless, of the minimization measures, including the temporary transplanting, individuals of the listed plants are likely to die because they are not located prior to construction and are crushed and/or they do not survive transplanting. In addition, a portion of the seed bank will likely be lost from ground disturbance. Mowing activities during vegetation maintenance will injure some plants and could possibly kill individuals depending on the extent of damage during mowing. When considering adverse effects, the Service errs on the side of the species; therefore, we estimate that any and all Florida bonamia, Lewton's polygala, papery whitlow-wort, sandlace, scrub buckwheat, and scrub mint within the construction area will likely be injured or killed during clearing and/or transplanting activities. Based on the survey results we anticipate this will include: 1) two Florida bonamia plants near MP 9.0; 2) one Lewton's polygala plant near MP 8.9; 3) five groups of papery whitlow-wort documented along the pipeline corridor between MPs 8.0 and 35.6 with an estimated total of 66 plants; 4) approximately 10 individual sandlace

near MP 35.5; 5) the patches of scrub buckwheat with approximately 50 individual plants between MPs 8.8 and 9.0; and 6) the scrub mint between MPs 8.4 and 9.0, estimated to include approximately 160 individual plants. We anticipate that mowing will injure any plants that do survive; however, because these plants are adapted to fire, we do not anticipate that the limb loss during mowing will kill any of the plants.

Florida bonamia occurs in 10 counties in peninsular Florida and is abundant on roadsides in Ocala National Forest. The loss of two plants as a result of the Project will not reduce the viability or the range of the species.

Lewton's polygala occurs in six counties in central Florida. There are 49 known occurrences (populations) of the species, of which 32 (65 percent) occur on private or public conservation lands. The loss of one plant as a result of the Project will not reduce the viability or the range of the species.

Papery whitlow-wort occurs in 5 counties in Florida and is present within essentially all the scrub conservation lands on Lake Wales Ridge. The loss of the 66 plants is a small fraction of the total population and will not reduce the viability or the range of the species.

Sandlace occurs in five counties and has benefited from the extensive State and private land acquisition programs on the Lake Wales Ridge since it was listed. The loss of the 10 plants is a small fraction of the total population and will not reduce the viability or the range of the species.
Scrub buckwheat occurs in seven counties in Florida and its long-term prospects are considered favorable due to habitat acquisition after it was listed, as well as efforts by conservation land managers to restore natural fire regimes. The loss of 55 individual plants from the action area is a small fraction of the total population and its distribution and will not reduce the viability or the range of the species.

Scrub mint, has fewer than 10 (5 to 8) viable populations. The scrub mint population in the action area is within the Horse Creek population, which numbered over 1,000 plants in 1998. Although FSC has the potential to kill 16 percent (160 individuals) of the known population, plants are expected to remain in the seedbank and re-establish following the construction. It is unlikely that the Project will destroy all of the plants and the seedbank and the species is expected to recolonize. Consequently, the Project is not expected to reduce the viability or the range of the species.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future state, tribal, local or private actions that are reasonably certain to occur in the action area. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act. Speculative non-federal actions are also not considered in this analysis.

Table 5 lists the actions that FERC identified that are reasonably certain to occur in proximity to the Project action area. These projects were identified through FERC's review of publically available information and consultations with State and local agencies and development authorities. Nearly all of the reasonably certain to occur actions can be classified as residential/commercial developments, road expansion/modification projects, or mining expansions. Not all of these actions occur within the Project action area; however, the Service's information on these actions is limited; thus, we rely on the information provided by FERC.

Table 5. Future actions that are reasonably certain to occur and were considered by FERC for cumulative impacts (FERC 2016; Table 3.14-1)

FSC Project	Project	Location	Description	Status
Residential and Other Developments	Oak Hills Estates (Providence)	Abuts to the west at MP 2.9	Regional impact multi-purpose development	Approved 5th Restated and Amended development order 2014; see section 3.9.3.4
	Progress Energy Florida Loughman Substation	Crosses MP 1.4	Non-residential site plan	Approved site plan
	New Destiny Church	Crosses MPs 1.4 to 1.5	Non-residential site plan	Approved site plan
	Shopping Center	Crosses MP 1.7	Non-residential site plan	Unknown – Identified through landowner consultation, no existing records or permits on file with Polk County have been located to date
	Tropical Lakes	Crosses MPs 2.1 to 2.3	Subdivision	Approved site plan
	Aviana Two A	Crosses MPs 2.3 to 2.5	Subdivision	Approved site plan
	Providence N4	Crosses MPs 2.3 to 2.5	Subdivision	Approved site plan
	N. Davenport MHE #2 Verizon	Crosses MPs 2.7 to 2.9	Non-residential site plan	Approved site plan
	Campbell Crane Company 6713	Crosses MPs 3.0 to 3.1	Non-residential site plan	Approved site plan
	Lake Marion Development Crosses	MPs 13.5 to 13.8 and MPs 14.0 to 15.5	Development Project	Re-zoning approved 2009; no other related developments or approvals
	Watersong AKA Country Creek	Crosses MPs 5.4 to 5.7	Subdivision	Approved site plan
	Sand Hill Fire Rescue Station	Crosses MPs 16.4 to 16.4	Non-residential site plan	Approved site plan
	Estes Groves	Crosses MPs 19.9 to 21.1	Low density residential and multiuse village center	Master concept plan
	Multi Use Village Center Future Land Use	1,000 ft west of MP 20.5	Moderate density single family residential and multiuse village center	Intent to complete build out of the multiuse village center and be compatible with the Estes Groves development
	Mountain Lake Corporation	Crosses MPs 25.0 to 25.5	Non-residential site plan	Approved site plan
	Mountain Lake Corporation	Crosses MPs 25.7 to 25.7	Non-residential site plan	Approved site plan

	Mountain Lake Corporation	Crosses MP 25.8	Non-residential site plan	Approved site plan
	The Pentecostals of Lake Wales 0804	Crosses MP 30.6	Non-residential site plan	Approved site plan
	Florida Rock-Diamond Sand Mine	2,000 ft north of MP 30.9	Subdivision	Approved site plan
	Monier Lifetile Training Center	Crosses MP 31.4	Non-residential site plan	Approved site plan
	Lake Wales Facility Rinker 0803	Crosses MPs 31.4 to 31.7	Non-residential site plan	Approved site plan
	Monier Lifetile 0803	Crosses MPs 31.4 to 31.6	Non-residential site plan	Approved site plan
	Citrosuco North America, Inc	Crosses MPs 31.9 to 32.7	Non-residential site plan	Approved site plan
	Carson Mini-Warehouses 0812	Crosses MPs 33.3 to 33.4	Subdivision	Approved site plan
	Lake Aurora Christian Assembly	Crosses MPs 34.2 to 34.4	Non-residential site plan	Approved site plan
	Calvary Baptist Church 0914	Crosses MPs 38.9 to 39.1	Non-residential site plan	Approved site plan
	Oakwood Subdivision	Crosses MPs 28.0 to 29.0	Residential subdivision	Preliminary plan approved; no recent activity
	RIDA/Championsgate Center	3.5 miles west of MP 0.0	Residential and multiuse village center	Approved; 5th Amended Site Plan 2009
	Industrial Site	65 ft east of MP 72.8	Proposed industrial site	Proposed
	The Reserve	10.4 miles east of MP 115.7	Non-residential site plan	Approved site plan 2013
Roadway Projects	Central Polk Parkway	1,500 ft west of MP 20.0	Florida DOT project proposed as a six-lane, new alignment highway in Polk County that will serve as additional north/south routes	Project development and environmental study phase; not scheduled for construction
	State Route 60 Widening	Crosses/collocates approximate MPs 31.0 to 74.0	Florida DOT road widening project	Project development and environmental study phase; not scheduled for construction
Mining Operations	St. Helena Sand Mine 9713	Crosses MPs 23.6 to 23.8	Non-residential site plan	Approved site plan
	CEMEX Construction Materials Florida, LLC 0810/0811	Crosses MPs 31.6 to 31.9	Non-residential site plan	Approved site plan

Residential and Other Development

Due to the speculative nature of the housing and development markets and funding mechanisms for other projects, it is difficult to determine the amount of land that would ultimately be affected by these developments. In most cases, the development is anticipated to occur outside of the Project action area. Some of these development projects may impact wetlands, which could require consultation with the Army Corps of Engineers (Corps). Based on the information available, a subset of the developments is proposed in scrub habitat where skinks and listed plants may occur. We anticipate that any additional loss of occupied scrub habitat from the development projects will be minimal.

Roadway Projects

Generally, these projects would either traverse the Project right-of-way or would be located adjacent to or parallel the Project. Similar to a pipeline project, a roadway project requires clearing and working in a narrow corridor, typically 25 to 200 ft wide. A roadway project also requires a permanent conversion of land for operation and maintenance. However, unlike a pipeline project, a paved roadway is operated and maintained in a permanently disturbed and unnatural state. Establishing a roadway would result in the permanent loss of vegetation and associated wildlife habitat; displacement of wildlife; loss of soil and land use; and alteration of surface and groundwater flow and aesthetic characteristics. Roadway projects could also temporarily and/or permanently increase dust and impact local noise and air quality. Many of the Florida Department of Transportation (FDOT) projects undergo section 7 consultation with the Service through Federal Highways or the Corps. The Service is already coordinating with FDOT on the Central Polk Parkway Project. It is likely that both of the FDOT projects will undergo section 7 consultations and therefore, are not considered further within the cumulative effects analysis of this Biological Opinion

Mining Operations

Depending on the mine operator (and the underlying resources present), future clearing and excavation is likely to occur incrementally, affecting up to 100 acres of land or more. Because surface mining operations by definition require surface clearing and excavation, these activities are excluded from utility rights-of-way, and thus the operation of these facilities would not directly overlap with FSC Project action area. Therefore, they are not considered further in the cumulative effects analysis of this Biological Opinion.

CONCLUSION

After reviewing the current status of blue-tailed mole skink, sand skink, Florida bonamia, Lewton's polygala, papery whitlow-wort, sandlace, scrub buckwheat, and scrub mint, the environmental baseline for the action area, the effects of the proposed Project, and the cumulative effects, it is the Service's Biological Opinion that the FSC Project, as proposed, is not likely to jeopardize the continued existence of the blue-tailed mole skink, sand skink, Florida bonamia, Lewton's polygala, papery whitlow-wort, sandlace, scrub buckwheat, or scrub mint.

We have reached this conclusion for the blue-tailed mole skink and sand skink because 1) the 74.2 acres of occupied skink habitat will only be temporarily "lost" or degraded and is expected to regenerate and be occupied by skinks; 2) the number of skinks that will be killed is expected to be a small portion of the total population of each of these species; and 3) because the Project effects to habitat are temporary, they will not result in an overall decrease in the range of either species of skink. To offset the adverse effects of the temporary habitat degradation, FSC will purchase 5.61 acres of skink habitat in a Service approved sand skink conservation bank.

We have reached our non-jeopardy conclusion for the listed plants because 1) for Florida bonamia, Lewton's polygala, papery whitlow- wort, sandlace, and scrub buckwheat the distribution and abundance of each of the plant species is far greater than the number of individuals that will be lost, and the Project will not decrease the viability or range of the species; 2) for scrub mint even though the percent of individuals that will be lost is greater than for the other plant species, the Project will not decrease the viability or the range of the species; and 3) the disturbance caused by the construction and ongoing mowing activities will create open spaces that are expected to benefit the listed plants. Furthermore, if no other avoidance or minimization option is deemed feasible for the listed plants, FSC will coordinate with the Service, Florida Department of Agriculture & Consumer Services, individual landowners, and other potentially interested parties (*e.g.*, Bok Tower Gardens Rare Plant Conservation Program) to investigate feasibility of relocating some listed plant species to other protected lands (offsite) or using available rare plant seed bank resources (if any) to re-vegetate the right-of way.

No critical habitat has been designated for these species; therefore, none will be affected.

INCIDENTAL TAKE STATEMENT

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

The measures described below are non-discretionary, and must be undertaken by FERC so that they become binding conditions of any grant or permit issued to the FERC, as appropriate, for the exemption in section 7(o)(2) to apply. The FERC has a continuing duty to regulate the activity covered by this incidental take statement. If the FERC (1) fails to assume and implement the terms and conditions or (2) fails to require the FSC, to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental

take, FERC/FSC, must report the progress of the proposed Project and its impact on the species to the Service's South Florida Ecological Services Vero Beach Field Office as specified in the incidental take statement. [50 CFR § 402.14(i)(3)]

Sections 7(b)(4) and 7(o)(2) of the Act generally do not apply to listed plant species. However, limited protection of listed plants from take is provided to the extent that the Act prohibits the removal and reduction to possession of Federally listed endangered plants or the malicious damage of such plants on areas under Federal jurisdiction, or the destruction of endangered plants on non-Federal areas in violation of State law or regulation or in the course of any violation of a State criminal trespass law.

AMOUNT OR EXTENT OF TAKE ANTICIPATED

Blue-tailed mole skink and sand skink

Construction of the Project is expected to result in the incidental take of skinks that occupy the 74.2 acres of occupied skink habitat. Take will occur in the form of injury and/or mortality during construction due to land clearing and construction activities (*i.e.*, soil movement, trenching, land contouring, operation of vehicles, etc.) associated with the Project. In addition, skinks that escape construction activities are expected to be taken either in the form of harassment (due to missing foraging and/or mating opportunities) or in the form of mortality (due to predation). The amount of incidental take of blue-tailed mole skinks and sand skinks will be difficult to quantify because the density of skinks within the 74.2 acres of habitat is unknown. Skink density varies considerably within and between apparently suitable habitat patches and density dependent mechanisms are currently unknown and may be due to territorial requirements, micro-habitats, and other unknown environmental influences. Therefore, we estimate that any and all adult, immature, or eggs of blue-tailed mole skinks and sands skinks that occur within the 74.2 acres of habitat will be taken in the form of harassment, injury, and/or mortality.

Furthermore, the Service anticipates incidental take of blue-tailed mole skinks and sand skinks will be difficult to detect because individuals have a small body size, spend the majority of their time underground, and the likelihood of finding a dead or impaired specimen is unlikely. Because numbers of skinks are difficult to quantify and take will be difficult to detect, take of skinks is measured by the amount of occupied habitat lost through implementation of the proposed Project, and is 74.2 acres. Authorized take will be considered exceeded if more than 74.2 acres of occupied skink habitat is lost. If, during the course of this action, this level of take is exceeded reinitiation of consultation under the Act is required.

Florida bonamia, Lewton's polygala, papery whitlow- wort, sandlace, scrub buckwheat, and scrub mint

As indicated above, Sections 7(b)(4) and 7 (o)(2) of the Act generally do not apply to Federally listed plant species. Consequently, the Florida bonamia, Lewton's polygala,

papery whitlow- wort, sandlace, scrub buckwheat, and scrub mint will not be discussed further in this incidental take statement.

EFFECT OF THE TAKE

In the accompanying biological opinion, the Service determined that this level of expected take is not likely to result in jeopardy to the blue-tailed mole skink or sand skink. Critical habitat has not been designated for the species and will not be affected.

REASONABLE AND PRUDENT MEASURES

When providing an incidental take statement, the Service is required to give reasonable and prudent measures it considers necessary or appropriate to minimize the take along with terms and conditions that must be complied with, to implement the reasonable and prudent measures. Furthermore, the Service must also specify procedures to be used to handle or dispose of any individuals taken. The Service believes the following reasonable and prudent measures are necessary and appropriate to reduce take and to minimize the direct and indirect effects of the proposed Project on the blue-tailed mole skink and sand skink:

1) Ensure that the level of incidental take anticipated in this biological opinion is commensurate with the analysis contained herein.

2) Minimize effects to blue-tailed mole skink and sand skink and their habitat.

TERMS AND CONDITIONS

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

1) The following term and condition implements reasonable and prudent measure 1:

    a. Before proceeding with any construction activities on the approximately 4 percent of the Project lands that FSC was unable to access and survey (because land owner permission was not received) prior to consultation, FERC/FSC must conducted appropriate surveys to evaluate whether the Project may affect listed species. If the proposed Project may affect any listed species, re-initiation of consultation will be necessary prior to commencement of construction on these lands.
    b. FSC must develop a skink monitoring plan that documents the recolonization of skinks into the construction right-of way, demonstrating the temporary nature of the Project's effects to occupied skink habitat.

c. The monitoring plan must include a minimum of ten monitoring locations from the sixteen locations where FSC documented skinks (Table 4).
d. Monitoring will occur at a minimum during the first 3 years following restoration of the skink habitat within the right-of-way, and during two subsequent years (to be decided) if skinks have not been documented to return during the first 3 years. Monitoring at any of the identified locations can be discontinued once skinks have been documented at that particular location.
e. The monitoring plan implemented must be approved by the Service.
f. The monitoring plan must be established and approved within 6 months of the initiation of construction of the Project.

2) The following term and condition implements reasonable and prudent measure 2:

a. FSC will submit to the Service's South Florida Ecological Services Field Office a letter that documents the purchase of the 5.61 acre-credits of skink habitat at a Service approved skink conservation bank, prior to starting any clearing or construction activities within the 74.2 acres of occupied skink habitat.

MONITORING AND REPORTING REQUIREMENTS

Pursuant to 50 Code of Federal Regulations 402.14(i)(3), the FERC/FSC must provide adequate monitoring and reporting to determine if the amount or extent of take is approached or exceeded. FERC/FSC must provide an annual report notifying the Service as to progress of Project construction and amount of habitat effected within areas with occupied skink habitat. FERC/FSC is required to monitor and verify that the number of acres of occupied skink habitat impacted by the FSC Project does not exceed 74.2 acres. FERC/FSC must also provide a report to the Service detailing the monitoring for skinks and their status as identified in the final skink monitoring plan. FSC must submit their reports to the Service's South Florida Ecological Services Field Office.

DISPOSITION OF DEAD OR INJURED SPECIMEMS

Upon locating a dead, injured, or sick individual of an endangered or threatened species, initial notification must be made to the Fish and Wildlife Service Law Enforcement Office at: U.S. Fish and Wildlife Service ;1339 20th Street, Vero Beach, Florida; 772-562-3909. Additional notification must be made to the South Florida Ecological Services Field Office. Care should be taken in handling sick or injured individuals and in the preservation of specimens in the best possible state for later analysis of cause of death or injury. In conjunction with the care of sick or injured specimens, or preservation of biological materials from a dead animal, the finder has the responsibility to carry out instructions provided by Law Enforcement to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed.

COORDINATION OF INCIDENTAL TAKE STATEMENTS WITH OTHER LAWS, REGULATIONS, AND POLICIES

Migratory birds

The Migratory Bird Treaty Act (MBTA) implements various treaties and conventions between the U.S., Canada, Japan, Mexico, and the former Soviet Union for the protection of migratory birds. Under the provisions of the MBTA, it is unlawful "by any means or manner to pursue, hunt, take, capture or kill any migratory bird except as permitted by regulations issued by the Service. The term "take" is not defined in the MBTA, but the Service has defined it by regulation to mean to pursue, hunt, shoot, wound, kill, trap, capture or collect any migratory bird, or any part, nest or egg or any migratory bird covered by the conventions or to attempt those activities.

The Service carries out its mission to protect migratory birds by fostering relationships with entities that have taken effective steps to avoid take, by encouraging others to implement measures to avoid take, and through investigations and enforcement when appropriate. Agencies are encouraged to work closely with the Service to identify available protective measures when developing project plans to safeguard wildlife and to implement those measures where applicable. Ultimately, those parties involved with the planning, design, construction, operation, maintenance, and decommissioning of projects are responsible for conducting relevant evaluations of the area and for determining which, if any, bird species may be affected.

SMP developed a Migratory Bird Conservation Plan. It includes Species of Conservation Concern; Habitats in the SMP Project Area; Project Effects on Habitats and Migratory Birds; Potentially Effected Birds of Conservation Concern; Avoidance, Minimization, and Mitigation Strategies; and Wetland Effects. FSC will implement this Migratory Bird Conservation Plan to minimize impacts on migratory birds from the Project.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to use their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. In order for the Service to be kept informed about additional actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the Service requests to be kept informed about any additional conservation measures that FERC or FSC implements into the Project. The Service recommends the following conservation measures:

1) To the greatest extent possible FSC should preserve and replace any topsoil that is moved within scrub habitat where listed plants (*i.e.*, Florida bonamia, Lewton's polygala, papery whitlow- wort, sandlace, scrub buckwheat, and scrub mint)

occur. This will provide a greater opportunity for the listed plants to survive and reestablish from the seedbank.

2) FSC should limit relocation of plants to the minimum number of times possible and no more than two times. If possible, listed plants should only be relocated one time. Following relocation, plants should be cared for and provided water to improve the probability that the individual will survive.

3) FSC should conduct monitoring of the plants that are relocated and provide the Service's South Florida Ecological Service Office annual reports documenting the success and/or failure of the relocation efforts.

4) FSC should conduct post-construction vegetation monitoring within the scrub habitat right-of-way for a minimum of two years. Monitoring reports should detail the success of right-of-way restoration, amount of re-vegetation, and level of invasive species colonization, as well as the management measures implemented to control any invasive species.

REINITIATION NOTICE

This concludes formal consultation on the FSC Project. As written in 50 CFR § 402.16, reinitiation of formal consultation is required where discretionary FERC involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, the exemption issued pursuant to section 7(o)(2) will have lapsed and any further take would be a violation of section 4(d) or 9. Consequently, we recommend that any operations causing such take cease pending re-initiation.

Thank you for your cooperation and effort in protecting federally listed species and fish and wildlife resources. The Service appreciates the cooperation of the FERC/FSC during this consultation. For further coordination on the skink monitoring plan, and if you have any questions, please contact Ted Martin at 772 469-4232 of this office.

Sincerely yours,

for Roxanna Hinzman
Field Supervisor
South Florida Ecological Services Office

Enclosures

cc: electronic only
Corps, Jacksonville, Florida (Deborah Wegmann, Mark Evans)
FERC, Washington D.C. (Danny Laffoon, John Peconom)
FSC, Juno Beach, Florida (Jena Mier)
FPL, Juno Beach, Florida (Matthew Raffenberg)
FWC, West Palm Beach, Florida (Marissa Krueger)
Service, Jacksonville, Florida (Annie Dziergowski, Todd Mecklenborg)
Service, Tallahassee, Florida (Cindy Fury)

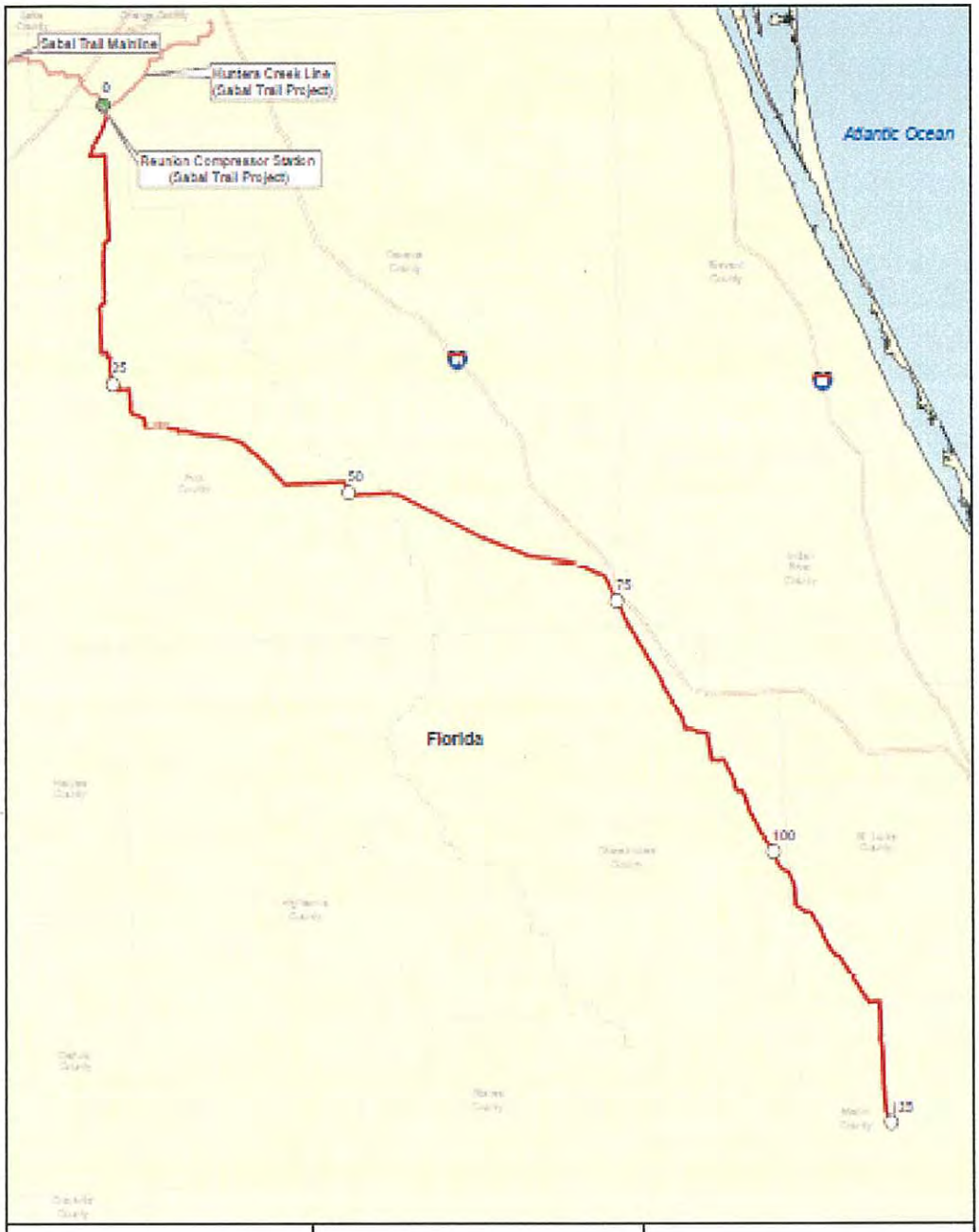

Figure 1. Florida Southeast Connection Gas Pipeline Project Overview

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STATUS OF THE SPECIES – Blue-tailed mole skink (*Eumeces egregius lividus*)

Legal Status – Federal: *threatened*, 1987; State: *threatened*

The blue-tailed mole skink was listed as threatened under the Endangered Species Act of 1973, as amended (Act) (87 Stat. 884; 16 U.S.C. 1531 *et seq*.) on December 7, 1987 (52 FR 42658- 52 FR 42662), and is listed as threatened by the State of Florida. The historic and anticipated future modification and destruction of xeric upland communities in central Florida were primary considerations in listing. Almost 90 percent of the xeric upland communities on the Lake Wales Ridge (LWR) have already been lost because of habitat destruction and degradation due to residential development and conversion to agriculture, primarily citrus groves (Turner *et al.* 2006). Remaining xeric habitat on private lands is especially vulnerable because projections of future human population growth suggest additional demands for residential development within the range of the blue-tailed mole skink. Critical habitat has not been designated for the blue-tailed mole skink.

Species Description

Appearance/Morphology

The blue-tailed mole skink (*Eumeces egregius lividus*) is a small, fossorial lizard that occupies xeric upland habitats of the southern LWR in central Florida (Mount 1965; Christman 1992). It reaches a maximum length of about 5 inches (in) (12.7 centimeters [cm]), and the tail makes up about half the body length (Christman 1978; 1992). The body is shiny, and brownish to pink in color, with lighter paired dorsolateral stripes diverging posteriorly (Christman 1978; 1992). Males develop a colorful orange pattern on the sides of the body during breeding season (Christman 1992). Juveniles usually have a blue tail (Christman 1978; 1992). Regenerated tails and the tails of older individuals are typically pinkish. The legs are somewhat reduced in size and used only for surface locomotion and not for "swimming" through the sand (Christman 1978; 1992).

Taxonomy

Mount (1965) described the blue-tailed mole skink largely on the basis of a bright blue tail in juveniles and restricted this subspecies to the southern LWR in Polk and Highlands Counties. Christman (1978) also limited the range of blue-tailed mole skink to these two counties, but later added Osceola County to the range, based on the collection of a single blue-tailed mole skink juvenile just north of the Polk County line on the LWR (Christman 1992). Analysis of mitochondrial DNA (Branch *et al.* 2003) supports Mount's (1965) hypotheses that blue-tailed mole skink from the lower LWR represents the ancestral stock, which radiated from there. Genetic analysis also indicates substantial population variability with limited dispersal in mole skinks among sandy habitats (Branch *et al.* 2003). Based on conventional estimates of molecular evolutionary clocks, these authors suggest a separation of approximately 4 million years between mole skinks occurring on the two oldest ridges (LWR and Mount Dora Ridge), which overlaps the proposed Pliocene origin of scrub habitats (Webb 1990).

Five subspecies of mole skinks have been described, all of which occupy xeric upland habitats of Florida, Alabama, and Georgia (Mount 1965), but only the blue-tailed mole skink (*Eumeces egregius lividus*) is federally listed as threatened (52 FR 42658). The taxonomic classification of the mole skink has been reevaluated, and there is evidence to suggest that it should be revised (Griffith *et al.* 2000; Brandley *et al.* 2005; Smith 2005). Brandley *et al.* (2005) and Smith (2005) formally proposed that the name *Plestiodon* be used to describe the Genus of the North American skinks. However, until such time as it can be officially designated through the Federal Register process, the Service continues to use the scientific name as published in the final listing rule (52 FR 42658). A detailed description of the recent taxonomic review can be found in Service (2007a).

Life History

Blue-tailed mole skinks are typically found in a variety of xeric upland communities, including rosemary and oak-dominated scrub, turkey oak barrens, high pine, and xeric hammocks (Christman 1992). They are primarily found within the top 2 in (5 cm) of the soil surface (Mount 1963). Roaches, crickets, and spiders make up the bulk of the diet (Mount 1963; Smith 1982; McCoy *et al.* 2010). Smith (1982) suggested that their diet is more generalized than that of the fossorial sand skink (*Neoseps reynoldsi*), which probably reflects their tendency to feed at the surface. However, McCoy *et al.* (2010) suggest that the dietary diversity of mole skinks is very similar to sand skinks or perhaps even more specialized. Also, like sand skinks, mole skinks show an activity peak in spring (Mount 1963; Smith 1982).

The reproductive biology of the blue-tailed mole skink is poorly known. Reproduction is presumably very much like that of the peninsula mole skink (*Eumeces egregius onocrepis*) where courtship and mating occur in the fall and winter (Mount 1963; Christman 1978). In the peninsula mole skink, individuals probably become reproductively active at 1 to 2 years of age (Mount 1963; Christman 1978). Two to nine eggs are laid in a shallow nest cavity less than 12 in (30.5 cm) below the surface (Mount 1963; Christman 1978). The eggs incubate for 31 to 51 days, during which time the female tends the nest (Mount 1963; Christman 1978). Females have a large clutch size (maximum nine) of relatively small eggs (Mount 1963).

Habitat

A variety of xeric upland communities provide habitat for the blue-tailed mole skink, including rosemary and oak-dominated scrub, turkey oak barrens, high pine, and xeric hammocks (Christman 1992). Areas with few plant roots, open canopies, scattered shrub vegetation, and patches of bare, loose sand provide optimal habitats (Christman 1988; 1992). Within these habitat types, blue-tailed mole skinks are typically found under leaves, logs, palmetto fronds, and other ground debris (Christman 1992). Shaded areas presumably provide suitable microhabitat conditions for thermoregulation, egg incubation, and foraging (Mount 1963).

Specific physical structures of habitat that sustain sand skink populations, and likely blue-tailed mole skink populations as well, include a well-defined leaf litter layer on the ground surface and

shade from either a tree canopy or a shrub layer, but not both (McCoy 2011). Leaf litter likely provides important skink foraging opportunities. Shade provided by a tree canopy or a shrub layer likely helps skinks regulate body temperature to prevent overheating. However, having both a tree canopy and a shrub layer appears to be detrimental to skinks (McCoy 2011).

Turner *et al.* (2006) reported that development and agriculture have resulted in the loss of approximately 85% of the scrub and sandhill habitats on the LWR, and what remains contains high concentrations of imperiled species. Over the last 20 years, more than 87 square kilometers (km^2) (48.9%) of the remaining 187 km^2 of these habitat types on the Lake Wales Ridge have been acquired and protected (Turner *et al.* 2006). Therefore, only 6.3% of pre-settlement scrub and sandhill habitats are currently protected (Turner *et al.* 2006).

In addition to the need for these remaining scrub and sandhill habitats to be protected, these habitats along with those on sites that have already been acquired for conservation depend upon active management, most often prescribed fire, to persist long-term (Turner *et al.* 2006). Much of the remaining habitat occurs in small, isolated fragments surrounded by residential areas or citrus groves, making them difficult to protect and manage. Many of these fragments are overgrown and in need of restoration. It is unknown whether or not small, fragmented properties are able to maintain viable populations.

Either natural fire started by lightning or prescribed fire is necessary to maintain habitat in natural scrub ecosystems. However, if fire occurs too frequently, leaf litter might not build up sufficiently to support skink populations. At Archbold Biological Station (ABS), fossorial sand skinks appear to be most abundant after 10 years of leaf litter development. The ideal fire frequency to maintain optimal leaf litter development for skinks likely varies by site and other environmental conditions (Mushinsky 2011). Although this information is specific to sand skinks, the same may be true for blue-tailed mole skinks.

Distribution

The blue-tailed mole skink historically occurred on the LWR in Highlands, Polk, and Osceola Counties (Service 1999). Despite intensive sampling efforts in scrub habitat with similar herpetofauna, neither the sand skink nor blue-tailed mole skink have been recorded at Avon Park Air Force Range on the Bombing Range Ridge (Branch and Hokit 2000). It appears that skinks are still distributed throughout their historic range, although we believe their numbers have likely declined substantially because of habitat loss and degradation.

Turner *et al.* (2006) reported that blue-tailed mole skinks are known to occur in 23 locations, 22 of which are on the LWR. The authors did not indicate where the single site occurs from which blue-tailed mole skink is reported off of the LWR, but we believe that this record may be in error. The subspecies has not been documented elsewhere off of the LWR and is believed to be restricted to this ridge alone (Moler 2007; Mushinsky 2007).

Blue-tailed mole skinks often seem absent or rare on the same LWR study sites where sand skinks are common, and when present, are patchily distributed (Christman 1988, 1992;

Mushinsky and McCoy 1995). Mount (1963) noted peninsula mole skinks also are patchily distributed and mostly occurred on xeric sites greater than 100 acres (ac) (40 hectares [ha]) in size. The distribution of the blue-tailed mole skink appears to be closely linked to the distribution of surface litter and, in turn, suitable microhabitat sites. Campbell and Christman (1982) characterized blue-tailed mole skinks as colonizers of a patchy, early successional, or disturbed habitat, which may occur as a result of natural or anthropogenic factors. Susceptibility of mature sand pine to windthrow may be an important factor in maintaining bare, sandy microhabitats required by blue-tailed mole skinks and other scrub endemics (Myers 1990).

Population Dynamics

The population dynamics of the blue-tailed mole skink are not well known because the skinks' diminutive size and secretive habits make their study difficult. The best current method available to detect blue-tailed mole skinks involves the raking of sand and organic liter and intensive searching, or the use of pit-fall traps and drift fences. Because these methods are laborious and time-consuming, they are not well suited for use over large areas. Unfortunately, cover board surveys used to detect sand skinks are not useful for specifically detecting the presence of blue-tailed mole skinks. As such, assessing the abundance and population trends of the blue-tailed mole skink over large areas is problematic.

Early maturity and a large clutch size of relatively small eggs (Mount 1963) suggest the population dynamics of mole skinks are different from sand skinks. Blue-tailed mole skinks appear to be far less common than sand skinks. A survey of seven protected sites conducted in 2004-2005 by Christman (2005) reported a density of 1.3 individuals per acre (0.53 per ha), compared to 56 sand skinks per acre (22.7 per ha), or a ratio of 1 blue-tailed mole skink for every 43 sand skinks collected. Previous studies indicated lower blue-tailed mole skink to sand skink ratios of 1:1.89 based on 54 total skinks captured in six trap arrays (Christman 1988), 1:4.3 based on 332 total skinks in 58 trap arrays (Mushinsky and McCoy 1991) and 1:2.7 based on 49 total skinks in 31,640 pitfall trap-days (Meshaka and Lane 2002). Christman (1992) suggested only 1 blue-tailed mole skink is encountered for every 20 sand skinks.

Peninsula mole skinks tend to be clumped in distribution with variable densities that may approach 25 adults per acre (10.12 per ha) (Mount 1963); however, it appears that blue-tailed mole skinks are much rarer (Christman 1992). Telford (2007) suggests that this disparity in relative abundance of the two species may be explained by seasonal variation in activity and movements and year-round surveys should be conducted over an adequate number of years to minimize the effect of variation in rainfall in order to obtain better estimates.

Unfortunately, determining population stability and viability is unattainable with current information. Because of the ongoing habitat loss and degradation on the LWR, it is likely that overall populations are declining (Moler 2007).

Critical habitat

Critical habitat is not designated for this species.

Threats

Present or Threatened Destruction, Modification or Curtailment of its Habitat or Range

It is likely that ongoing residential and agricultural development of xeric upland habitat in central Florida has destroyed or degraded extensive tracts of habitat containing the blue-tailed mole skink. Continued habitat loss, fragmentation, and changes in land use threaten the existence of the subspecies. Unlike sand skinks, their tracks cannot be easily detected in the sand, and most of the extant scrub, including protected sites, on the LWR has not been adequately surveyed for blue-tailed mole skinks. Populations on private sites are threatened with destruction or habitat modification due to improper or lack of management.

The LWR encompasses approximately 517,303 ac (209, 345 ha) (Weekley *et al.* 2008*).* Roughly 69,683 ac of this area is protected in refuges, parks, State forests, wildlife and environmental areas, and on private lands, and, therefore, protected from general destruction (Turner *et al.* 2006). However, Turner *et al.* (2006) indicated that blue-tailed mole skinks seem to be underrepresented in the reserve network of protected public lands, but the authors could not determine if their absence reflects actual exclusion or a lack of survey effort. If the former is true, then additional lands must be protected and managed in perpetuity to ensure the survival of this subspecies (Turner *et al.* 2006).

Another concern is whether relatively small, isolated properties are able to maintain viable populations. There is evidence of an edge effect on sand skink distribution on isolated scrub fragments bordered by non-scrub habitat (Gianopulos 2001, Mushinsky *et al.* 2001). Gianopulos (2001) found that on scrub fragments bordered by non-scrub habitat, sand skinks were found more frequently within the middle of the sites than along the edges bordered by non-scrub habitat, and this difference was detected as far as 50 m (164 ft) into the sites. This could be a concern for blue-tailed mole skinks, as well.

Between 2005 and 2060 Florida's population is projected to double from approximately 18 to 36 million people (Zwick and Carr 2006). Assuming a similar pattern of development at current gross urban densities for each county, this translates into the need to convert an additional 7 million ac of undeveloped land into urban land uses (Zwick and Carr 2006). Over most of the range of the sand and blue-tailed mole skinks in the central region of Florida from Marion County southward to northern Polk and Osceola Counties, human population growth and the conversion of previously undeveloped lands to urban use is expected to be explosive (Zwick and Carr 2006). It is predicted that Osceola County is among the counties that will experience the greatest transformation from rural to urban land over the next 50 years (Zwick and Carr 2006). This is expected to be the result of population spillover from the build-out in Orange County (Zwick and Carr 2006).

The protection and recovery of blue-tailed mole skinks will require that habitat loss be limited to disturbed areas, and that suitable unoccupied habitat be restored. Current efforts to expand the system of protected xeric upland habitats on the LWR, in concert with implementation of

aggressive land management practices, represent the most likely opportunity for securing the future of this species.

Inadequacy of Existing Regulatory Mechanisms

In addition to protections associated with the Act and existing regulations on refuges and other protected lands where skinks occur, the blue-tailed mole skink is listed by the Florida Fish and Wildlife Conservation Commission as federally-designated threatened (Chapter 39-27, Florida Administrative Code). This legislation prohibits take, except under permit, but does not provide any direct habitat protection. Wildlife habitat is protected on Florida Fish and Wildlife Conservation Commission wildlife management areas and wildlife environmental areas according to Florida Administrative Code 68A-15.004. Therefore, the Act provides additional protection for these species and their habitat through section 7 (interagency cooperation), as well as through the prohibitions of section 9(a)(l) and the provisions of section 4(d) and recovery planning. Although section 7 and 9(a)(l) provide some regulatory protection, these provisions do not adequately protect against habitat loss. In addition, existing regulations are not specific enough to guard against loss of genetic integrity of the species. Research has shown that it is important to preserve certain areas of the historic range to maintain genetic diversity.

Other Natural or Manmade Factors Affecting its Continued Existence

Improper habitat management and invasion by nonnative and invasive species threaten the existence of blue-tailed mole skinks. Active management is necessary to maintain suitable habitat for skinks. Management of scrub habitat is problematic because much of the remaining habitat occurs in small fragmented areas surrounded by residential areas where prescribed burning may not be feasible. These residential areas are also often a source of nonnative plants that invade native habitat. Many of the fragments are overgrown and in need of restoration.

Habitat degradation on protected and private sites continues to be a threat because vegetation restoration and management programs are costly and depend upon availability of funding. Where prescribed fire is not feasible as a management technique because of smoke management and other concerns, mechanical treatment is sometimes used. However, heavy machinery disturbs the soil more than prescribed burning, and it removes often limited nutrients from the soil (Mushinsky *et al.* 2001). This changes the nutrient levels in the topsoil, affecting the vegetative composition of the site, whereas fire releases nutrients (Mushinsky *et al.* 2001). Also, if logs are removed from a site after mechanical treatment, prey abundance (termites) may be lower than it would be after a fire (Mushinsky *et al.* 2001).

Another threat to skinks is the loss of genetic diversity. Branch *et al.*'s (1999; 2003) work on sand skinks identified genetic distinctions among populations from the Mt. Dora Ridge, the northern LWR, the central LWR, and the southern LWR. Because each site where more than five individuals were sampled contained unique haplotypes, populations on isolated ridges should be protected to avoid the loss of genetic diversity. This likely applies to blue-tailed mole skinks, as well.

Climate Change and Sea Level Rise

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

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

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

For the blue-tailed mole skink, sea level rise is likely to increase man-made effects, as the human population moves from the coast to central parts of the State. This human migration will increase the demand for development and could lead to increased loss of upland xeric habitat. In addition, the increased human population would likely increase the threats associated with human interactions, such as fire suppression, habitat degradation, and nonnative species described above.

Ongoing Conservation Efforts

Over the last 20 years, a concerted effort by public and private institutions to protect the remaining undeveloped areas of the LWR has resulted in the acquisition of 21,498 ac (8,700 ha) of scrub and sandhill habitat (Turner *et al.* 2006). A variety of state and federal agencies and private organizations are responsible for management of these areas. The Service has also acquired portions of several tracts totaling 1,800 ac (728.4 ha) as a component of the LWR National Wildlife Refuge (Service 1993). Private organizations, such as The Nature Conservancy and ABS, have acquired and currently manage xeric uplands within the LWR. All of these efforts have greatly contributed to the protection of imperiled species including skinks on the LWR (Turner *et al.* 2006).

The Service has also certified six conservation banks totaling nearly 1,500 ac for sand and blue-tailed mole skinks, two in Highlands County and four in Polk County. Conservation banking provides an avenue for collaboration of private/public partnerships to maintain and preserve habitat, providing for the conservation of endangered species. These banks conserve and manage land in perpetuity through a Conservation Easement to offset impacts occurring elsewhere to the same resource values on non-bank lands. The certification of these banks should help reduce the piece-meal approach to skink conservation that can result from separate evaluation of individual projects by establishing larger reserves and improving connectivity of habitat.

Recovery of the skink may also require rehabilitation of suitable but unoccupied habitat or restoration of potentially suitable habitat. Translocation efforts may also be needed. Although blue-tailed mole skinks have not been translocated, we may be able to infer likelihood of success based upon success of similar species. Comparisons of persistence, recruitment, and survival were used to determine translocation success of skinks on two restored scrub sites for 6 years following relocation (Mushinsky *et al.* 2001; Penney 2001; Penney *et al.* 2001). One site established a self-sustaining population, while the other did not. It was determined that site location, habitat suitability, and initial propagule size were the factors affecting success; researchers concluded the chances of long-term survival may improve when habitat is restored and skinks are introduced to sites close to intact scrub, rather than to isolated sites (Mushinsky *et al.* 2001; Penney 2001). In another study, Osman (2010) found that survival of sand skinks was significantly greater on translocation sites with low soil moisture and no shade-providing object, and evidence of reproduction was observed more readily on sites with lower soil compaction and light intensities over the two-year study. He concluded that sand skinks can do well in multiple microhabitat conditions and microhabitat heterogeneity in and around these sites is important. Emerick (2015) monitored and analyzed long-term translocation success of sand skinks over a total of 7 years. He confirmed survival success of the offspring of founding individuals born on the site and determined those individuals were also successfully reproducing.

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STATUS OF THE SPECIES – Sand skink (*Neoseps reynoldsi*)

Legal Status

The sand skink was listed as threatened under the Endangered Species Act in 1987 (52 FR 42658), and is listed as federally-designated threatened by the state. Critical habitat has not been designated for the sand skink.

Species Description

Appearance/Morphology

The sand skink is a small, fossorial lizard that reaches a maximum length of about 5 inches (in) (12.7 centimeters [cm]). The tail makes up about half the total body length. The body is shiny and usually gray to grayish-white in color, although the body color may occasionally be light tan. Hatchlings have a wide black band located along each side from the tip of the tail to the snout. This band is reduced in adults and may only occur from the eye to snout on some individuals (Telford 1959). Sand skinks contain a variety of morphological adaptations for a fossorial lifestyle. The legs are vestigial and practically nonfunctional, the eyes are greatly reduced, the external ear openings are reduced or absent (Greer 2002), the snout is wedge-shaped, and the lower jaw is countersunk.

Taxonomy

The taxonomic classification of the sand skink has been reevaluated since it was listed as *Neoseps reynoldsi* in 1987 (52 FR 42658), and the commonly accepted scientific name for the sand skink is now *Plestiodon reynoldsi* (Brandley *et al.* 2005; Smith 2005). A detailed description of the recent taxonomic review can be found in Service (2007). We continue to use the scientific name as published in the final listing rule (52 FR 42658).

The sand skink is believed to have evolved on the central Lake Wales Ridge (LWR) and radiated from there (Branch *et al.* 2003). Analysis of mitochondrial DNA indicates populations of the sand skink are highly structured with most of the genetic variation partitioned among four lineages: three subpopulations on the LWR characterized by high haplotype diversity and a single, unique haplotype detected only on the Mount Dora Ridge (MDR) (Branch *et al.* 2003). Under the conventional molecular clock, the 4.5 percent divergence in sand skinks from these two ridges would represent about a 2-million year separation. The absence of haplotype diversity on the MDR would suggest this population was founded by only a few individuals or severely reduced by genetic drift of a small population (Branch *et al.* 2003).

Life History

The sand skink is usually found below the soil surface burrowing through loose sand in search of food, shelter, and mates. Sand skinks feed on a variety of hard and soft-bodied arthropods that occur below the ground surface. The diet consists largely of beetle larvae and termites (*Prorhinotermes* spp.). Spiders, larval ant lions, lepidopteran larvae, roaches, and adult beetles are also eaten (Myers and Telford 1965; Smith 1982).

Sand skinks are most active during the morning and evening in spring and at mid-day in winter, the times when body temperatures can easily be maintained at a preferred level between 82 and 88 degrees Fahrenheit in open sand (Andrews 1994). During the hottest parts of the day, sand skinks move under shrubs to maintain their preferred body temperatures in order to remain active near the surface. With respect to season, Telford (1959) reported skinks most active from early March through early May, whereas Sutton (1996) found skinks most active from mid-February to late April. Based on monthly sampling of pitfall traps, Ashton and Telford (2006) found captures peaked in March at Archbold Biological Station (ABS), but in May at the Ocala National Forest (ONF). All of these authors suggested the spring activity peak was associated with mating. At ABS, Ashton and Telford (2006) noted a secondary peak in August that corresponded with the emergence of hatchling sand skinks.

Telford (1959) assumed sand skinks become sexually mature during the first year following hatching, at a size of 1.78 in (4.52 cm) snout-vent length. He suspected most of the breeders in his study were in their second year and measured between 1.78 and 2.24 in (4.52 and 5.69 cm) snout-vent length. However, Ashton (2005) determined sand skinks become sexually mature between 19 and 23 months of age and have a single mating period each year from February through May. Sand skinks first reproduce at 2 years of age and females produce a single clutch in a season, although some individuals reproduce biennially or less frequently (Ashton 2005). Sand skinks lay between two and four eggs, typically under logs or debris, in May or early June (Ashton 2005; Mushinsky in Service 2007), approximately 55 days after mating (Telford 1959). The eggs hatch from June through July. Sand skinks can live at least to 10 years of age (Meneken *et al.* 2005). Gianopulos (2001) found the sex ratio of sand skinks did not differ significantly from 1:1, which is consistent with the findings of Sutton (1996).

Most sand skinks move less than 130 feet (ft) (39.6 meters [m]) between captures, but some have been found to move over 460 ft (140.2 m) in 2 weeks (Mushinsky *et al.* 2001). Limited dispersal ability has been suggested to explain the relatively high degree of genetic structure within and among sand skink populations (Branch *et al.* 2003; Reid *et al.* 2004). Analysis of blood and fecal samples obtained from 20 sand skinks in ONF demonstrated that no blood parasites were present and only normal protistan and helminth symbiotes were observed, with no evidence of effect on survival of individuals or the population (Telford 1998). Similarly, a species of nematode (*Parapharyngodon ocalaensis*) was collected from the intestinal tracts of 22 sand

skinks (Bursey and Telford 2002). It is not known to be a threat to the species. In a subsequent paper, Telford and Bursey (2003) found 3 species of endoparasites in 45 sand skinks from ONF.

Habitat

The sand skink is widespread in native xeric uplands with excessively well-drained soils (Service 2012), principally on the ridges listed above at elevations greater than 80 ft (24.4 m) above mean sea level. Commonly occupied native habitats include Florida scrub variously described as sand pine scrub, xeric oak scrub, rosemary scrub and scrubby flatwoods, as well as high pine communities that include sandhill, longleaf pine/turkey oak, turkey oak barrens and xeric hammock (see habitat descriptions in Myers 1990 and Service 1999). Coverboard transects extended from scrub or high pine (sandhill) through scrubby flatwoods to pine flatwoods revealed that sand skinks left more tracks in scrub than the other three habitats and did not penetrate further than 130 ft (39.6 m) into scrubby flatwoods or 65 ft (19.8 m) into pine flatwoods (Sutton *et al.* 1999). Sand skinks also use disturbed habitats such as citrus groves, pine plantations, and old fields, especially when adjacent to existing scrub (Pike *et al.* 2007; 2008).

Various authors have attempted to characterize optimal sand skink habitat (Telford 1959; 1962; Christman 1978; 1992; Campbell and Christman 1982). Literature descriptions of scrub characteristics have not proven very useful to predict sand skink abundance, but expert opinion was more successful (McCoy *et al.* 1999). McCoy *et al.* (1999) used trap-out enclosures to measure sand skink densities at seven scrub sites and attempted to rank each area individually based on eight visual characteristics to identify good habitat: (1) root-free, (2) grass-free, (3) patchy bare areas, (4) bare areas with lichens, (5) bare areas with litter, (6) scattered scrubs, (7) open canopy, and (8) sunny exposure. None of the individual literature descriptions of optimal habitat (or any combination thereof) accurately predicted the rank order of actual sand skink abundance at these sites, which ranged in density from 52 to 270 individuals per acre (ac) (Sutton 1996). However, knowledgeable researchers, especially as a group, appear to be able to visually sort out the environmental variables important to sand skinks, but had difficulty translating their perceptions into a set of rules that others could use to identify optimal sand skink habitat (McCoy *et al.* 1999).

Multiple studies (Collazos 1998; Hill 1999; Mushinsky and McCoy 1999; Gianopulos 2001; Mushinsky *et al.* 2001) have determined the relationship between sand skink density and a suite of environmental variables. These studies have found sand skink relative density was positively correlated with low canopy cover, percent bare ground, amount of loose sand and large sand particle size, but negatively correlated with understory vegetation height, litter cover, small sand particle size, soil moisture, soil temperature, and soil composition. In an unburned sandhill site at ABS, Meshaka and Lane (2002) captured significantly more sand skinks in pitfall traps set in openings without shrubs than at sites with moderate to heavy shrub density. Telford (1959) suggested scattered debris and litter provided moisture that was important to support an abundant

food supply and nesting sites for sand skinks. Cooper (1953) noted the species was most commonly collected under rotting logs, and Christman (1992) suggested they nest in these locations. Christman (2005) found skinks continue to occupy scrub with a closed canopy and thick humus layer, although at lower densities. Recent surveys have also shown sand skinks may occupy both actively managed lands, such as citrus groves and pine plantations, and old-field communities (Pike *et al.* 2007), particularly if these sites are adjacent to patches of native habitat that can serve as a source population for recolonization.

Experimental studies have been conducted to investigate the effects of management techniques, such as mechanical treatment and prescribed burning, on sand skink abundance. Several studies found a decrease in relative abundance of skinks immediately following both mechanical and burning treatments (Mushinsky and McCoy 1999; Gianopulos 2001; Gianopulos *et al.* 2001; Mushinsky *et al.* 2001; Sutton *et al.* 1999). Gianopulos (2001) and Gianopulos *et al.* (2001) reported a significant increase in skink captures in mechanical treatment plots over the 5-year period following the treatment. However, a clear increase in skink numbers following a burn was not observed (Navratil 1999; Gianopulos *et al.* 2001; Mushinsky *et al.* 2001). Christman (2005) conducted trap surveys at sites with a known burn history on the LWR in Polk and Highlands Counties and did not observe a strong correlation between skink density and number of years since the site was burned. Mushinsky *et al.* (2001) noted significantly larger skinks were captured in burned plots, indicating more insect prey may have been available from decaying logs or older skinks inhabited these sites.

Habitat size may be a factor in maintaining viable skink populations. Pike *et al.* (2006) monitored sand skinks and quantified vegetation change in six areas from 5 to 69 ac (2 to 27.9 hectare [ha]) that were restored to a more natural state using fire and canopy thinning, and set aside for conservation in residential areas. Pike *et al.* (2006) documented a severe decline in occupancy and relative density of sand skinks, and hypothesized indirect impacts from surrounding development, such as changes in soil hydrology, may have caused the decline. Hydrologic changes in the soil may have occurred as a result of construction of retention ponds or run-off from neighborhoods that caused a rise in the groundwater level (Pike *et al.* 2006). The population decline of skinks noted may also have been caused by prescribed burning used to restore these sites (Mushinsky in Service 2007).

Distribution

The sand skink occurs on the sandy ridges of interior central Florida from Marion County south to Highlands County. The extant range of the sand skink includes Highlands, Lake, Marion, Orange, Osceola, Polk, and Putnam Counties (Christman 1988; Telford 1998). Principal populations occur on the LWR and Winter Haven Ridges (WHR) in Highlands, Lake, and Polk Counties (Christman 1992; Mushinsky and McCoy 1991). The sand skink is uncommon on the MDR, including sites within the ONF (Christman 1970; 1992). Despite intensive sampling

efforts in scrub habitat with similar herpetofauna, the sand skink has not been recorded at Avon Park Air Force Range on the Bombing Range Ridge (Branch and Hokit 2000). Although we do not have estimates of acreage for all of the ridges, we do know the largest of these, the LWR, encompasses approximately 517,303 ac (209,300 ha) (Weekley *et al.* 2008). According to the Florida Natural Areas Inventory (FNAI) database, updated as of September 2006, there were 132 locality records for the sand skink, including 115 localities on the LWR, 7 on the MDR, and 4 on the WHR (Griffin 2007). FNAI also reports four localities for this species west of the MDR in Lake County and two localities between the LWR and the Lake Hendry Ridge.

Population Dynamics

Abundance (historical and current), population estimates, stability/viability

The current status of the sand skink throughout its geographic range is unclear because recent comprehensive, range wide surveys have not been conducted. At the time of Federal listing in 1987, FNAI had recorded 31 known sites for the sand skink. By September 2006, 132 localities were known by FNAI (Griffin 2007). This increase is largely the result of more intensive sampling of scrub habitats in recent years and does not imply this species is more widespread than originally supposed. Nonetheless, except for a few locations where intensive research has been conducted, limited information about the presence or abundance of sand skinks exists. Reptile surveys in a variety of scrub habitats in the ONF did not detect sand skinks (Greenberg *et al.* 1994). Telford (1998) cited the ephemeral nature of early successional scrub habitats due to dynamic changes as an important confounding factor in the evaluation of the sand skink's present status in the ONF. At least two persistent populations are known from the ONF (Telford 1998), where sand skinks have been collected for genetic analysis (Branch *et al.* 2003) and population studies (Ashton and Telford 2006). Additional studies have provided presence/absence information that has been used to determine the extant range of the species (Mushinsky and McCoy 1991; Stout and Corey 1995). However, few long-term monitoring efforts have been undertaken to evaluate the population size, or population trends, of sand skinks at these sites, on remaining scrub habitat on private lands, or rangewide.

The population dynamics of sand skinks within their extant ranges are not well known because the skinks' small size and secretive habits make their study difficult. Sand skinks are known to exhibit life-history traits that are also found in a number of other fossorial lizard species, such as: delayed maturity, a small clutch size of relatively large eggs, low frequency of reproduction, and a long lifespan (Ashton 2005). Such character traits may have resulted from, and be indicative of, high intraspecific competition or predation.

Threats

Present or Threatened Destruction, Modification or Curtailment of its Habitat or Range

The modification and destruction of xeric upland communities in central Florida were a primary consideration in listing the sand skink as threatened. By some estimates, as much as 90 percent of the scrub ecosystem has already been lost to residential development and conversion to agriculture, primarily citrus groves (Kautz 1993; Turner *et al.* 2006a). Xeric uplands remaining on private lands are especially vulnerable to destruction because of increasing residential and agricultural pressures.

Approximately 85 percent of xeric upland communities historically used by sand skinks on the LWR are estimated to have been lost due to development (Turner *et al.* 2006b). It is likely continued residential and agricultural development of xeric upland habitat in central Florida has destroyed or degraded habitat containing sand skinks. Protection of the sand skink from further habitat loss and degradation provides the most important means of ensuring its continued existence. Of the 73 locations examined by Turner *et al.* (2006a) on which sand skinks were reported, 39 are protected and, as of 2004, 27 were managed. Current efforts to expand the system of protected xeric upland communities on the LWR, coupled with implementation of effective land management practices, represent the most likely opportunity for assuring the sand skink's survival.

The 5-year review found no justification for change in the threatened status (Service 2007).

Ongoing Conservation Efforts

Over the last 20 years, a concerted effort by public and private institutions to protect the remaining undeveloped areas of the LWR has resulted in the acquisition of 21,498 ac (8,700 ha) of scrub and sandhill habitat (Turner *et al.* 2006). A variety of state and federal agencies and private organizations are responsible for management of these areas. The Service has also acquired portions of several tracts totaling 1,800 ac (728.4 ha) as a component of the LWR National Wildlife Refuge (Service 1993). Private organizations, such as The Nature Conservancy and ABS, have acquired and currently manage xeric uplands within the LWR. All of these efforts have greatly contributed to the protection of imperiled species including skinks on the LWR (Turner *et al.* 2006).

The Service has also certified six conservation banks totaling nearly 1,500 ac for sand and blue-tailed mole skinks, two in Highlands County and four in Polk County. Conservation banking provides an avenue for collaboration of private/public partnerships to maintain and preserve habitat, providing for the conservation of endangered species. These banks conserve and manage land in perpetuity through a Conservation Easement to offset impacts occurring elsewhere to the same resource values on non-bank lands. The certification of these banks should help reduce the piece-meal approach to skink conservation that can result from separate

evaluation of individual projects by establishing larger reserves and improving connectivity of habitat.

Recovery of the skink may also require rehabilitation of suitable but unoccupied habitat or restoration of potentially suitable habitat. Translocation efforts may also be needed. Comparisons of persistence, recruitment, and survival were used to determine translocation success of sand skinks on two restored scrub sites for 6 years following relocation (Mushinsky *et al.* 2001; Penney 2001; Penney *et al.* 2001). One site established a self-sustaining population, while the other did not. It was determined that site location, habitat suitability, and initial propagule size were the factors affecting success; researchers concluded the chances of long-term survival may improve when habitat is restored and skinks are introduced to sites close to intact scrub, rather than to isolated sites (Mushinsky *et al.* 2001; Penney 2001). In another study, Osman (2010) found that survival of sand skinks was significantly greater on translocation sites with low soil moisture and no shade-providing object, and evidence of reproduction was observed more readily on sites with lower soil compaction and light intensities over the two-year study. He concluded that sand skinks can do well in multiple microhabitat conditions and microhabitat heterogeneity in and around these sites is important. Emerick (2015) monitored and analyzed long-term translocation success of sand skinks over a total of 7 years. He confirmed survival success of the offspring of founding individuals born on the site and determined those individuals were also successfully reproducing.

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STATUS OF THE SPECIES – Florida bonamia (*Bonamia grandiflora*)

The following discussion is summarized from the Multi Species Recovery Plan (MSRP; Service 1999), as well as from research publications and monitoring reports. A complete Florida bonamia (*Bonamia grandiflora*) life history discussion may be found in the MSRP. No critical habitat has been designated for Florida bonamia.

Description

Florida bonamia is a perennial vine with long prostrate stems a meter or more (at least 3 feet) in length. It has a long, relatively slender tap root. The leathery sessile or subsessile leaves are up to 4 centimeters (cm; 1.6 inch) in length and ovate in shape. The flowers are solitary and sessile in the leaf axils. The funnel-shaped corolla is 7 to 10 cm (3 to 4 inches) long and 7 to 8 cm (2.7 to 3.2 inches) across. It has a deep blue or bluish-purple color with a white throat. The flowers open in the morning and are wilted by early afternoon (Romano 1999). The fruits are capsules, normally containing four seeds. The seeds are smoothish, pale brown or greenish-brown, 5 to 8 millimeters (mm) long, and oblong (Romano 1999). The outer face is convex and the inner two faces are flat, forming an angle (Wunderlin et al. 1980). Florida bonamia is the only morning glory vine found in scrub areas with a large blue flower (Wunderlin *et al.* 1980), but could be confused with hairy dawnflower (*Stylisma villosa*).

Life History and Population Dynamics

Florida bonamia grows for three or more years (50 FR 42068; Wunderlin *et al*. 1980), flowering from spring to summer (Wunderlin 1998). It has a mixed mating system; it is highly self-compatible, it can self-pollinate, and it can produce seeds without fertilization (Romano 1999). Pollinators are essential, however, to ensure substantial seed production by self-, as well as cross-, fertilization. Florida bonamia shows some inbreeding depression in selfed fruits and seeds but it does not appear to be enough to hinder the present populations (Romano 1999). The seeds of Florida bonamia become dormant, but may not require dormancy to germinate, particularly if the seeds are planted immediately. Hartnett and Richardson (1989) observed that populations of this species have large seed banks of dormant seeds, mostly within 1 cm (0.4 inch) of the surface, distributed rather homogeneously, with no relation to the distribution of mature plants. The seedlings germinate throughout the summer until September. This germination pattern is somewhat unusual among scrub plants, many of which germinate during the fall or winter. Germination occurs on sites with sparse vegetation that have not burned recently (Romano 1999).

Seedling survival was investigated by Romano (1999), but results from this unpublished dissertation have not yet been obtained. Hartnett and Richardson (1989) excavated several plants. They found that clumps of prostrate stems seen at the surface are connected to a large central and somewhat woody rootstock. They had no difficulty distinguishing such clump-forming, well-established older individuals from young single-stem plants that had grown from seed. According to Hartnett and Richardson (1989), fire stimulates seed production and germination as well as regrowth from clonal stems. Stem production is greatest during the first

season after a fire, while seed production peaks the second year. The lag is probably due to the increased energy needed for regrowth following fire. Seed production is postponed to conserve energy. New seed production replaces the seed banks that are often destroyed by fire.

Distribution and Status

The known populations of Florida bonamia occur within, on the edge of, or near scrub habitat on the white sands associated with the ancient Pleistocene dune systems of the central ridge system (Ward 1979). Scrub vegetation, particularly on the Ocala National Forest (ONF), consists of myrtle oak and sand live oak with sand pine (*Pinus clausa*), with openings between the trees and shrubs occupied by lichens and herbs. Scrub is renewed by infrequent fires or mechanical disturbances, including logging on the ONF. Florida bonamia grows in a variety of growth stages of sand pine, but flowers profusely only in the open, sunny conditions of regeneration stands, and sparsely if at all in older stands.

Florida bonamia also occupies disturbed areas near roadways and clearings caused by logging operations (50 FR 42068). This species is not found on altered soils such as the clay applied to logging roads on the ONF (Miller 1989). As the scrub community reaches maturity, encroachment and shading from overstory pines and oaks cause this and other smaller species to decline (Wunderlin *et al.*1980a).

Florida bonamia has been collected in Hardee, Highlands, Hillsborough, Lake, Manatee, Marion, Orange, Polk, Sarasota, and Volusia Counties in peninsular Florida. Many of these records are historic: Manatee (1878, 1916), Sarasota (1878), and Volusia (1900) (Wunderlin *et al.* 1980). The plant has been collected in Hardee County in 1995 and in Orange County in 1989 and 1995 (University of Florida herbarium collections catalog, accessed June 28, 2005). Florida bonamia is relatively abundant and widespread on the ONF, especially along road edges, in Marion and Lake Counties. South of the ONF, Florida bonamia was once collected near Mt. Dora or Tavares, but has probably been extirpated.

Florida bonamia depends on the sunny cleared areas left by periodic fires or physical disturbance (52 FR 42068). Historically, lightning fires swept through the scrub and surrounding communities, burning large tracts of land. Today, habitat fragmentation and fire suppression have interrupted the natural burn regime. Reduced fire frequency has left many of the scrub sites overgrown and unsuitable for highly specialized scrub endemics that require open sunny patches. Florida bonamia, like other herbs of the scrub, can be found growing along roadsides that are often the only available openings. However, these areas cannot be considered a safe refuge for rare species. Roadsides are often filled with invasive exotics that compete with scrub endemics. In addition, road maintenance activities such as mowing, herbicide spraying, and soil disturbance can adversely affect native species.

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Status of the Species – Lewton's polygala
U.S. Fish and Wildlife Service
November 2010

STATUS OF THE SPECIES – Lewton's polygala (*Polygala lewtonii*)

Lewton's polygala (*Polygala lewtonii*) was federally listed as an endangered species on April 27, 1993 (58 FR 25746, Service 1993). Critical habitat has not been designated. The species is listed as endangered by the State of Florida. In addition to the assessment below, a 5-year review was completed in 2010 resulting in no change to the species designation as endangered (Service 2010). No critical habitat has been designated for this species. The 5-year review builds upon the detailed information in the Multi Species Recovery Plan (MSRP; Service 1999) and is located at http://www.fws.gov/southeast/5yearReviews/5yearreviews/20100806%20Lewton's%20polygala%20Five-Year%20Status%20Review.pdf

Species/Critical Habitat Description

Lewton's polygala, a member of the milkwort family (Polygalaceae), is an herb reaching a height of 20 centimeters (cm) [8 inches (in)]. It produces one to several annual stems, which are spreading, upward curving or erect, and are often branched. The leaves are small, sessile, and tend to overlap along the stem. Three types of flowers are produced – aboveground open-pollinated (chasmogamous) flowers, aboveground self-pollinated flowers that do not open (aboveground cleistogamous), and belowground closed self-pollinated flowers that do not open (belowground cleistogamous) (Weekley 1996). Chasmogamous flowers are in erect, loosely five flowered racemes about 1.5 cm to 3.3 cm (0.6 to 1.2 in) long. Each flower is about 0.5 cm (0.2 in) long and bright pink to purplish-red. Two of the five sepals are enlarged and wing-like, between which the largest of the three petals forms a keel that ends in a tuft of finger-like projections. This species is closely related to the widespread *P. polygama*, which forms larger clumps and has a longer root, narrower leaves, and differently shaped wing sepals (Wunderlin *et al*. 1981).

Lewton's polygala occurs almost exclusively on yellow sands in sandhill (high pine) and oak-hickory scrub (Menges and Weekley 2003), and transition zones between these two communities. In the Ocala National Forest, Lewton's polygala but also in scrub in areas that probably were former sandhill sites prior to logging and fire suppression (Weekley 2010).

Life History

Lewton's polygala is a relatively short-lived (5 to 10 years) perennial (TNC 2008, Weekley and Menges, submitted). Lewton's polygala is amphicarpic, producing flowers and fruits above and below ground (Menges and Weekley 2002). It produces three kinds of flowers: aboveground open-pollinated Chasmogamous (CH) flowers, belowground self-pollinated cleistogamous (CL) flowers, and aboveground self-pollinated CL flowers (Menges and Weekley 2003). CH flowers are usually produced in the spring; CL flowers are usually produced in the summer or fall. However, observations suggest that flowering periods for both CH and CL

flowers are variable, and that sexual reproduction is not confined to a specific season (Menges *et al.* 2008).

While self-fertilization occurs in Lewton's polygala, it appears to be a less-reliable mechanism for seed production than insect pollination. Insect pollination increases the fruit set of CH flowers (Weekley and Brothers 2006). Prominent pollinators include bee-flies (Bombyliidae), flower flies (Syrphidae) and leaf-cutter bees (Megachilidae) (Menges *et al*. 2006).

Lewton's polygala seeds have a fleshy appendage called an elaiosome which is a protein- and lipid-rich body common among ant-dispersed seeds. The elaiosome attracts ants, which presumably benefit the plant by distributing the seeds to appropriate microsites. At least eight species of ants collect seeds of Lewton's polygala, the most frequent being *Pheidole morrissii* (Menges and Weekley 2002, 2003).

Lewton's polygala is one of only a few dozen amphicarpic angiosperms known worldwide, among them several species of *Polygala* (James 1957). Amphicarpy is viewed as an adaptation for reproduction in uncertain habitats, for example, producing seeds underground where they have better chances of surviving fire (Cheplick and Quinn 1982) and are protected from herbivory (Menges and Weekley 2003).

Population Dynamics

Fire is the predominant natural disturbance in Florida and a primary driver in the demography of all Florida scrub and sandhill plants that have been studied (Menges 2007). Plants of Lewton's polygala are consumed by fire and post-fire resprouting is extremely rare (Weekley and Menges 2003). The beneficial effects of fire on Lewton's polygala include removal of litter, competing vegetation, and ground lichens (Menges and Weekley 2004). Usually, Lewton's polygala responds to fire with abundant seedling recruitment (Menges and Weekley 2003), which often results in populations increases of at least one order of magnitude (Menges and Weekley 2005). For example, Menges and Weekley (2003) documented an 800 percent increase following the 2001 prescribed fire at the Carter Creek unit of the Lake Wales Ridge National Wildlife Refuge (LWRNWR).

Demographic monitoring indicates that: (1) seedling recruitment is markedly higher in burned than unburned areas for the first six months post fire, (2) survival was higher for plants that recruited in burned plots, (3) plants in burned areas reach reproductive age more quickly, (4) burned microsites have greater plant density than unburned ones, and (5) any increase in density-dependent mortality is outweighed by the first three benefits. Menges *et al*. (2006) recommend that fire frequencies for Lewton's polygala be at least every 4 years, due to the rapid decline in population size as time-since-fire increases.

The response of Lewton's polygala may vary from one fire to another depending on post-fire precipitation patterns, with lower seedling recruitment when fire occurs during drier seasons (Menges *et al*. 2009). Higher rates of recruitment are observed in El Niño winters, when rainfall is greater and temperatures are lower than average (Weekley and Menges, submitted). Major

seedling recruitment events are linked to winter rainfall (Menges and Weekley 2003) and about 75 percent of all seedling recruitment occurs between October and March (Menges *et al*. 2007).

Evidence suggests that a persistent seed bank is important to post-fire recovery of Lewton's polygala populations (Weekley and Menges, submitted). Seeds can remain intact within the soil and retain viability for at least 2 years (Menges and Weekley 2004). They are capable of surviving short-term heat pulses lethal to living cells, which underground seeds might be subjected to during fire (Menges and Weekley 2004). The chemical compounds in smoke may also cue or improve seed germination (Lindon and Menges 2008). Populations occurring at sites with a long period of fire suppression may retain the potential for dramatic increase. For example, Menges and Weekley (2002) reported a dramatic increase in seedling recruitment following a fire on a sandhill site that had not burned in 60 years. Data from long-unburned populations suggest that even small (fewer than 50 plants) populations can persist without fire through occasional small-scale seedling recruitment events (Menges *et al.* 2007).

Status and Distribution

Lewton's polygala occurs in sandhill (high pine) vegetation and Florida scrub of the Lake Wales and Mount Dora ridges in Highlands, Polk, Osceola, Orange, Lake, and Marion Counties of central Florida.

The 5-Year Status Review for Lewton's polygala identified 49 extant occurrences and six that are presumed extirpated (Service 2010). Of the 49 extant occurrences, 32 (65 percent) are protected on publicly owned land (23 occurrences) or private conservation land (9 occurrences). Protected occurrences span 13 different managed areas. Seventeen of 49 extant occurrences (35 percent) are located on private property (excluding those on private conservation lands) where they have no protection from development and are threatened by lack of fire and other management. The status of 14 of the 17 unprotected occurrences on private property is uncertain. See the Lewton's polygala 5 –year Status Review (Service 2010) for descriptions of known occurrences on private land.

Lewton's polygala occurs within the following managed areas : Ocala National Forest (U.S. Forest Service), Scrub Point Preserve (Lake County Water Authority), Warea Tract of the Seminole State Forest [Florida Department of Forestry (FDOF)], Allen D. Broussard Memorial Catfish Creek Preserve (Florida Department of Environmental Protection), Horse Creek Scrub (South Florida Water Management District), Pine Ridge Preserve (Bok Tower Gardens), Tiger Creek Preserve (The Nature Conservancy), Crooked Lake Sandhill (Polk County), Lake Wales Ridge State Forest - Arbuckle, Walk-In-Water, and Hesperides tracts (FDOF), Carter Creek unit of LWRWEA (Florida Fish and Wildlife Conservation Commission), and the Carter Creek unit of LWRNWR (Service).

The distribution of Lewton's polygala has decreased over the past 100 years as the central Florida has been transformed by commercial and residential development. Large-scale destruction of upland habitat on the Lake Wales Ridge began in the 1880s. Citrus growers favored yellow sands and many sites potentially supporting Lewton's polygala were converted to citrus production in the early decades of the 20th century. Weekley *et al*. (2008) estimated that 78 percent of the xeric upland habitat on the Lake Wales Ridge was destroyed by1990, and

greater than 85 percent by 2006, mainly due to agriculture, ranching, and commercial and residential development.

Habitat loss has played a large role in the current abundance and distribution of Lewton's polygala. The loss and fragmentation of habitat has resulted in scattered, mostly small, populations. All known occurrences are protected in the northernmost portion of the species range in Marion County, but a gap in protection exists in Lake, Orange, and Osceola Counties (approximately one-fourth of the range of Lewton's polygala), where only two of 14 occurrences are protected.

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STATUS OF THE SPECIES – Papery whitlow-wort **(***Paronychia chartacea* ssp. *chartacea*)

The following discussion is summarized from the South Florida Multi-Species Recovery Plan (MSRP) (Service 1999), as well as from recent research publications and monitoring reports. A complete papery whitlow-wort life history discussion may be found in the MSRP. No critical habitat has been designated for the papery whitlow-wort.

Description

Papery whitlow-wort is a small mat-forming herb with many bright yellowish-green branches radiating flatly from a taproot (Kral 1983; Small 1933). The stems are two to nine inches long and wiry. The leaf blades are small and sessile, ovate to triangular-ovate in shape, and strongly revolute. The plant has numerous small cream-colored to greenish flowers (Small 1933; Service 1996) that produce a very thin-walled one-seeded dry fruit that remains intact, functioning as a "seed" (Kral 1983).

This species consists of two geographically isolated subspecies, with papery whitlow-wort (*Paronychia chartacea* ssp. *chartacea*) in the Florida peninsula (Anderson 1991) and the similar Crystal Lake nailwort (*P. chartacea* ssp. *minima*) in the Florida panhandle. This discussion is limited to the peninsula subspecies.

Life History

Flowering and fruiting occur in late summer or fall (Anderson 1991) and the seeds mature in September or October (Race 1996). This species is a short-lived perennial (Anderson 1991 and observations by staff at the Historic Bok Sanctuary).

Population dynamics

Papery whitlow-wort is most frequently seen in open, sunny gaps in rosemary balds within scrub vegetation (Abrahamson *et al.* 1984, Christman 1988, Menges and Kohfeldt 1995). At Archbold Biological Station, rosemary scrubs are found only on the higher ridges and knolls surrounded by scrubby flatwoods with dense oaks. The main soil types are St. Lucie and Archbold (Abrahamson *et al.* 1984), which are both well-drained white sands (U.S. Dept. of Agriculture, Soil Conservation Service 1989). The fire cycle in rosemary scrub can range from 10 to as long as 100 years (Johnson 1982, Myers 1990). Rosemary scrub has abundant Florida rosemary (*Ceratiola ericoides*) and scrub oaks including Chapman oak (*Quercus chapmannii*), sand live oak (*Q. geminata*), Archbold oak (*Q. inopina*) and occasional sand pine *(Pinus clausa*). The open sandy areas of rosemary scrub contain small herbs and lichens (Abrahamson *et al.* 1984, Hawkes and Menges 1996). These gaps in the dense vegetation are more persistent in rosemary scrubs than in scrubby flatwoods (Hawkes and Menges 1996).

Papery whitlow-wort also occurs in high pineland (upland longleaf pine vegetation, also called "sandhill") in the Walk in the Water tract of Lake Wales Ridge State Forest (Cox 2002), at The Nature Conservancy's Crooked Lake Sandhill Preserve (B. Pace-Aldana, TNC, in litt. 2002), and at the Tiger Creek Preserve.

In studies of the responses of plants to fire in rosemary balds, Johnson and Abrahamson (1990) and Ostertag and Menges (1994) identified two groups of scrub plants—those that resprout after a fire and those that return from seed. They found that papery whitlow-wort appeared in rosemary balds after fires, even though it had been rare or absent prior to the burn. This strongly indicates that papery whitlow-wort maintains seed banks in the soil, waiting for suitable germination conditions. Within about 9 to 12 years after a fire, papery whitlow-wort was displaced by Florida rosemary and reindeer lichens (*Cladonia* and *Cladina*) (Johnson and Abrahamson 1990). Some gap plants such as snakeroot and Highlands scrub hypericum disappear relatively quickly after fires and require large populations consisting of tens of thousands of plants to persist (Quintana-Ascencio and Menges 2000), but papery whitlow-wort persists longer after fire and it has many large populations over a relatively large geographic range, compared to other Lake Wales Ridge endemic plants.

The density of papery whitlow-wort increases in relation to available open space (Hawkes and Menges 1996; Menges and Kohfeldt 1995), so the species is most abundant in disturbed, sandy areas such as road rights-of-way and recently cleared high pine (Abrahamson et al. 1984; Christman 1988; Service 1996). Papery whitlow-wort can become very abundant after a fire or on disturbed sites such as along fire lanes or trails (Service 1996; Johnson and Abrahamson 1990) and is least likely of the federally-listed scrub plants to suffer local extirpations as open areas become covered by shrubs.

Loose sand affects papery whitlow-wort. According to research by Petrů and Menges (2004), "the demographic responses of the species to sand movements indicate that mobile sands create constantly shifting arrays of microsites that can influence post-dispersal seed germination, survival, and growth of Florida scrub herbs. Roadside habitats have more dynamic patterns of sand movement than natural gaps and may alter selection regimes important for demographic variation of endemic Florida scrub plants." Papery whitlow-wort persists on road edges in the absence of fire in the vegetation. These roadside sandy areas constitute habitats that are significantly different from the bare areas within the vegetation, and may be less suitable for persistence of the species. This research bolsters the already-substantial evidence that prescribed fire is essential to maintain Florida scrub vegetation and its biota, including other federally listed plants and animals.

Management for papery whitlow-wort requires burning regimes that mimic the natural fire cycles of rosemary scrub. Relationships among fire, open space, and plant distributions within a xeric scrub are complex and need to be studied further (Hawkes and Menges 1996). Management practices for rosemary scrub should include fire at intervals suitable for a variety of plants and animals, rather than at intervals optimized for just a single species (Hawkes and Menges 1996; Quintana-Ascencio et al. 2003).

Status and distribution

Papery whitlow-wort occurs on the Lake Wales Ridge and at least one smaller nearby

ridge (Kral 1983), in Highlands, Polk, Osceola, Orange, and Lake Counties (Anderson 1991). It is present on the small ridge at the Lake McLeod tract of Lake Wales Ridge National Wildlife Refuge, but not on the Bombing Range Ridge on Avon Park Air Force Range. On the Lake Wales Ridge it is present in essentially all of the scrub conservation lands. Since the last comprehensive survey (Schultz *et al*. 1999), it has been found in high pineland at the Walk in Water tract of Lake Wales Ridge State Forest (Cox 2002). It is also present in high pineland on the Tiger Creek Preserve, owned by The Nature Conservancy.

The northern range limit of papery whitlow-wort is in Lake County, where it occurs on the north side of Lake Louisa at Crooked River Preserve, owned by the Lake County Water Authority. It was possibly present at a nearby site, Schofield Sandhill that had been proposed for acquisition under the Florida Forever program, but the acquisition proposal did not come to fruition. The only site on conservation lands in Orange County (also at the northern range limit) is the small Shadow Bay Park (formerly Lake Cane-Marsha Park) near where the Florida Turnpike crosses Interstate 4. The species was reported from localities in western Orange County, but the area has since become urbanized, and there are few if any opportunities for setting aside conservation lands in this area. The only papery whitlow-wort site in Osceola County for that has been proposed for State acquisition is at Lake Davenport, in the northwestern corner of the County. It has not been purchased (FNAI 2005).

Papery whitlow-wort is present on essentially all conservation lands with scrub on the Lake Wales Ridge in Polk and Highlands Counties. The southernmost sites on conservation lands are Gould Road (part of the Lake Wales Ridge Wildlife and Environmental Area operated by the Florida Fish and Wildlife Conservation Commission) and Archbold, both in Highlands County south of Lake Placid (Schultz *et al*. 1999).

During 2003, the Florida Fish and Wildlife Conservation Commission and Archbold Biological Station purchased adjoining portions of a ranch that bordered the Biological Station's preserve to the west. The recently-acquired land provides an important buffer for Archbold, and it protects additional habitat for this species, both occupied and restorable.

Although Florida Natural Areas Inventory (FNAI) data provide the best available overall view of the distribution of this species, intensive local inventories add important detail. The Lake Wales Ridge State Forest is represented in the FNAI database by nine element occurrences, yet the Arbuckle tract of the Forest has 188 records of this plant in its GIS database, based upon an inventory by K. DeLaney in 1988 (data provided by A. Cox, Florida Department of Agriculture and Consumer Services). Of the 188 records, 23 represented more than 100 individuals.

Archbold Biological Station has not monitored this plant because it thrives in fire lanes that usually do not have exotic plant problems (E. Menges and M. Deyrup 1995, in

Service 1996). The propensity of this species to occupy fire lanes, roadsides, and other artificially disturbed areas is a primary conservation concern for the papery whitlow-wort, because it tends to be far more abundant in such disturbed areas than within the vegetation itself. This situation was researched by Petrů and Menges (2004), and they confirmed that prescribed fire is essential to create and restore open, sandy habitat for this and other plants.

The papery whitlow-wort occurs in association with several other federally listed species: in scrub, Florida bonamia, Highlands scrub hypericum, wireweed, Florida perforate cladonia, snakeroot, and scrub blazing star. In high pineland at the Tiger Creek Preserve, pygmy fringe tree, pigeon wings, scrub buckwheat, Britton's beargrass, scrub plum, and Carter's mustard.

Papery whitlow-wort is the most abundant and widespread of the listed Lake Wales Ridge scrub and high pineland plants, and it has benefited greatly from acquisition of conservation lands in its range. Like several other scrub species, including Highlands scrub hypericum, is particularly abundant in human-disturbed areas such as road edges and fire lanes. Researchers based at Archbold Biological Station are interested in finding ways to lessen these plants' dependence on such artificial habitats through restoration of fire regimes.

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STATUS OF THE SPECIES – Sandlace (*Polygonella myriophylla*)

The following discussion is summarized from the South Florida Multi-Species Recovery Plan (MSRP) (Service 1999), as well as from recent research publications and monitoring reports. A complete sandlace (*Polygonella myriophylla*) life history discussion may be found in the MSRP. No critical habitat has been designated for sandlace.

Description

Sandlace is a sprawling shrub with zigzag branches that tend to hug the ground, rooting at the nodes (Wunderlin *et al.* 1980) and forming low mats, sometimes reaching that looks somewhat like the ornamental creeping juniper (*Juniperus horizontalis*). Its many branches zigzag along the ground and root at the nodes, forming low mats. The lower parts of the creeping branches have bark that cracks and partly separates in long, flat, interlacing strips. The short lateral branches end in flowering racemes. Sandlace has the sheathing leaf stipules (ocreae and ocreolae) typical of the jointweed family. The leaves are needle-like and are from 0.3 to 10.0 millimeters (mm) (0.1 to 0.4 inches) long. The small, white or cream colored flowers have white petallike sepals up to 3.4 mm (0.1 inch) long (Kral 1983). It flowers and fruits all year.

Sandlace, a member of the jointweed family (Polygonaceae), is one of three species of *Polygonella* that occur in Florida scrub in Highlands and Polk Counties of south central Florida (Lewis and Crawford 1995). While the species have rather similar inflorescences and flowers, the shrubby habit of sandlace is extremely distinctive—nothing else will be mistaken for it, and for that reason the early status surveys of scrub (Christman 1988) provided very accurate coverage of its distribution.

Life history

Sandlace occupies open, sandy areas within the scrub vegetation, and it appears to require fire or other disturbances that create or maintain these sandy gaps. This species is killed by fire, and reoccupies burned sites from seed (Pedro Quintana-Ascencio, University of Central Florida, pers. comm. 2004). Its abundance can easily be overestimated, because it tends to colonize disturbed areas along easily accessible road cuts and rights-of-way. Weekley and Menges (2003) confirmed that sandlace does not resprout after fire, but recolonizes burned areas from seed arriving from unburned areas, and perhaps by spreading from unburned areas. Pollinators of sandlace are genus-specific bees and likely a few varieties of wasps. Little is known about seed production and germination for this species, but seedlings do not survive in the vicinity of the mature plants, which are allelopathic, meaning they produce chemicals that inhibit the growth and survival of other nearby plants (Weidenhamer *et al.*1989). The major allelochemicals are gallic acid and hydroquinone (Weidenhamer and Romeo 2004). Most of the available information on the life history of this plant comes from a study of cutting and burning of scrub,

conducted by Archbold Biological Station ecologists (Quintana-Ascencio *et al*. 2004). This study did not focus on sandlace, but it provided valuable data on it and other species. The study has emphasized the value of disturbance (fire or mechanical) in this ecosystem. Although fire kills individual plants, sandlace benefits from fires or other disturbances that create sandy gaps that can be occupied by new plants that grow from seed. Like most other Lake Wales Ridge endemics, sandlace is threatened by fire suppression and habitat loss resulting from agricultural and residential development (Service 1999).

Menges (1999) presents useful information on scrub management, although very productive research, monitoring, and experience has been conducted since then. Menges and his colleagues at Archbold Biological Station have regularly cautioned that management of wireweed and other endemic plants on conservation lands should not employ as benchmark their presence or abundance in altered habitats. Instead, management decisions should be made to maintain and enhance the dynamic diversity of Florida's scrub vegetation, encouraging the endemic plants to re-occupy scrub vegetation that may have become overgrown and unsuitable in the absence of fire. These ecologists have suggested using staggered burning schedules, providing a variety of return frequencies that will accommodate the differing needs of various species of the scrub biota (Quintana-Ascencio *et al.* 2003).

Population Dynamics

Because sandlace is a sprawling clonal shrub, with plants taking root where their stems touch the ground (Wunderlin et al. 1980), individuals may spread significant distances by vegetative means. For this reason, it is difficult to identify genetically-distinct individuals (Quintana-Ascencio 2004). Despite being a narrow endemic, it has the highest within-population genetic diversity of any species in the genus *Polygonella*, which includes several very widespread species (Lewis and Crawford 1995).

Little is known of the population biology of this species. Based on work on other scrub species, such as *Polygonella basiramia* (wireweed) (Boyle *et al.* 2003), it is clear that the bare sand areas (gaps) occupied by sandlace fluctuate dramatically in size, expanding after a fire and contracting until the next fire. As a result, sandlace, like wireweed, probably has metapopulation dynamics, with local populations in gaps expanding after fire and potentially going extinct, either as a result of a long interval between fires or the fires themselves.

Status and Distribution

Sandlace's range is from Orange County south through Highlands County in scrub vegetation. It occurs near Interstate 4 in Orange County and at one site in northwestern Osceola County. In Polk County, sandlace is found on the LWR from the Davenport-Poinciana area. It is also found well west of the Lake Wales Ridge in a highly altered

area just southeast of Bartow. In Highlands County, sandlace is found on the Lake Wales Ridge as far south as the Archbold Biological Station.

Sandlace is present on the following scrub properties acquired, or under acquisition, for conservation purposes. Areas of tracts (in acres) were obtained from the Florida Natural Areas Inventory (FNAI) database 2001, updated through the FNAI website in November 2004.

1. The Allen David Broussard Catfish Creek Preserve State Park comprises 3,268 hectares (8,077 acres) operated by the Florida Department of Environmental Protection. It has a management plan, active fire management with annual requests for prescribed burning, and rare plant monitoring.
2. Hickory Lake Scrub County Park is a 23 hectare (57 acre) tract owned by Polk County. It has a management plan, prescribed fire management, and rare plant monitoring.
3. Saddle Blanket Lakes Preserve comprises 268 hectares (663 acres) owned by The Nature Conservancy.
4. Sun Ray Scrub is a component of the Lake Wales Ridge Wildlife and Environmental Area. Acreage for this tract is not available through the FNAI, but the tract as a whole is comparable in size to Saddle Blanket Lakes.
5. Lake Wales Ridge State Forest, operated by the Florida Department of Agriculture and Consumer Services, Division of Forestry, consists of three tracts. Collectively, they cover 10,719 hectares (26,488 acres).
    - Arbuckle,
    - Walk-in-the-Water, and
    - Babson/Hesperides.
6. The LWR National Wildlife Refuge, operated by the Service, consists of the Lake McLeod and Snell Creek units in Polk County and the Carter Creek and Flamingo Villas units in Highlands County. They comprise 744 hectares (1,839 acres). Sandlace is present at Lake McLeod and Flamingo Villas.
7. The Lake Wales Ridge Wildlife and Environmental Area, administered by the Florida Fish and Wildlife Conservation Commission, consists of 12 tracts, totaling over 6,543 hectares (16,167 acres). The tracts include Blue Lake, Silver Lake, Carter Creek, Henscratch, Highlands, Royce, Lake Apthorpe, Lake Placid, and McJunkin.
8. The Preserve, operated by Highlands County, comprises 559 hectares (1,380 acres), in part longleaf pine vegetation. Sandlace is probably present, but not confirmed.
9. Highlands Hammock State Park comprises 3,743 hectares (9,251 acres). It has been expanded to include scrub.
10. Jack Creek, comprising 520 hectares (1,285 acres), is owned by the Southwest Florida Water Management District. It adjoins the Henscratch Road/Jack Creek tract of the Lake Wales Ridge Wildlife and Environmental Area.

11. Lake June-in-Winter Scrub State Park, located on the lake, comprises 342 hectares (846 acres).
12. The private Archbold Biological Station comprises over 3,592 hectares (8,877 acres). Sandlace is present, but rare.

Sandlace has benefited from the extensive State and private land acquisition programs on the LWR since it was listed, and it appears to be benefiting from prescribed fire programs on these lands.

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STATUS OF THE SPECIES – Scrub buckwheat (*Eriogonum longifolium*)

The following discussion is summarized from the Multi Species Recovery Plan (MSRP; Service 1999), as well as from recent research publications and monitoring reports. A complete scrub buckwheat life history discussion may be found in the MSRP. No critical habitat has been designated for scrub buckwheat.

Description

Scrub buckwheat belongs to the buckwheat family (*Polygonaceae*). It constitutes a variety of *Eriogonum longifolium*, a widespread species of the Great Plains that is represented east of the Mississippi by var. *harperi* in northern Alabama, Tennessee, and Kentucky (Kral 1983), and by *var. gnaphalifolium* in Florida (Reveal 1968).

Scrub buckwheat is a long-lived perennial herb with a substantial taproot that probably provides ample food reserves for resprouting (McConnell and Menges 2002), basal rosettes, and one to three or more leafless, upright above-ground flowering stems (scapes) up to 1 meter (m) (3 feet) tall, but upwards of 10 stems have been observed in vigorous specimens, especially post-fire. It has a basal rosette of leaves that are 15 to 20 centimeters (cm) (5.9 to 7.9 inches) long, narrow, and white-woolly on the underside. The stem leaves are smaller than the rosette leaves. The stem terminates in a corymb, with each branch of the corymb ending in a cup-shaped involucre that holds a cluster of 15 to 20 small flowers, with each flower hanging on its stalk down below the involucre. The involucre is silvery and silky-pubescent, while the flowers are green with pink anthers (Rickett 1967; Archbold Biological Station 2005).

This species is easiest to recognize when it is in flower or fruit. In Highlands County, Archbold Biological Station (2003) reports that plants produce flowering stalks mainly during summer (May through July), but scrub buckwheat can flower at other times of year following burns. Plants on the Ocala National Forest have been observed with immature flower stalks between April and mid-July and bloom from May to mid-October. Seedlings have been observed in a variety of substrates within a few feet of the parent plant (Clutts 1998).

Life History

Scrub buckwheat is a perennial herb distributed widely in sandhill (high pineland) and Florida scrub in north central and central Florida from Ocala National Forest through the Lake Wales Ridge (LWR). Its growing season is between April and mid-July and it flowers from May to mid-October. This species probably does not have a long-lived seed bank (Archbold Biological Station 2003).

Individual scrub buckwheat plants produce only one or a few flowers at any one time, but continues flowering for months. “Flowers have an easily accessible, generous drop of nectar.

Flowers are visited by a variety of insects, including solitary digger and twig-nesting wasps (*Parancistrocerus* spp. and *Stenodynerus* spp.), flies (*Geron* spp.), small solitary bees, and occasional social wasps. Visiting wasps learn the location of each plant and use trap-line strategies. The small number of flowers per plant induces them to visit several plants and probably promotes outcrossing. Individual flowers avoid self-pollination. The anthers open and shed their pollen first, then the pistils, which have kept their stigmas tucked into a tuft of hairs at the base of the flower, straighten up and offer their receptive surfaces to incoming insects. An extremely low number of seeds and fruits developed by experimentally bagged flowers (compared to open pollinated flowers) indicates the need of pollinator services to set seed" (Archbold Biological Station 2003).

Population Dynamics

Scrub buckwheat resprouts repeatedly after fire, which is the primary agent of disturbance in its sandhill and Florida scrub habitats (McConnell and Menges 2002). Fire benefits this plant by stimulating resprouting, which is followed by "quick and heavy flowering and seed production" (McConnell and Menges 2002). New seedlings appear promptly after seed drop. McConnell and Menges (2002) observed that seedling numbers peaked during July, 2 months after an experimental fire (and a month after another experimental treatment – litter removal). Scrub buckwheat is unlike most other scrub species in that seedlings will appear in summer, not just winter. This may allow the species to take advantage of summer rains, but seedlings are likely to desiccate during hot weather.

The seedlings that appear after a fire are unlikely to originate from a seed bank. McConnell and Menges (2002) observed that the seeds are very small, and those buried deeply enough to survive heat from a Florida scrub fire (about 2 cm) would be unlikely to reach the surface. Satterthwaite *et al*. (2002) placed fresh seeds at the soil surface and saw high germination rates.

This species occupies both sandhill and scrub vegetation, which have very different fire regimes. Sandhill vegetation, under historic natural conditions, burned roughly every 1 to 10 years, while scrub may burn at intervals of 5 to as much as 100 years (McConnell and Menges 2002; citing Menges 1999). Over the long term, a population viability analysis by Satterthwaite *et al.* (2002) shows that scrub buckwheat populations require fire at intervals of 5 to 20 years to remain viable.

Prescribed burning is the "most appropriate treatment for enhancing both seed production and seedling recruitment, and linking the two in time" (McConnell and Menges 2002). Because this species tolerates a wide variety of fire intervals, prescribed fire regimes do not have to be tailored to its specific needs. At the Carter Creek tract of the LWR National Wildlife Refuge (NWR), biologists from Archbold Biological Station have carried out experimental fires that show promise of restoring the vegetation by suppressing evergreen oaks, reducing the sizes of

turkey oaks, and improving conditions for reproduction by longleaf pines and wiregrass. This conclusion fits with monitoring and experimental work on scrub buckwheat and three other species, going back to Menges (1995), Menges and Yahr (1996, 1998), and Menges and Weekley (1999).

McConnell and Menges (2002) experimentally applied alternative treatments to promote a "demographic response" in scrub buckwheat. They applied top-clipping, litter canopy removal, shrub canopy removal, and ash addition in a replicated, factorial experiment. None of these treatments was as productive as fire. These and continuing work by Menges *et al*. (2005) suggest that for a long-unburned tract like the Carter Creek tract of LWR NWR, "pre-treatments to facilitate the application of fire management may be important to this and other species." In the Carter Creek experiments, a saw-and-burn treatment "created a hotter, more complete fire and more open post-treatment canopies. This had generally favorable effects on scrub buckwheat. The saw & burn treatment enhanced seedling recruitment, plant dormancy, flowering (both percentages and amount per plant) and reduced herbivory." The burn-only treatment was left with large unburned patches. These researchers are planning to analyze the effects of fire intensity on scrub buckwheat demography.

Status and Distribution

This was once a relatively widespread species. Its decline is due almost entirely to loss of sandhill habitat and to habitat degradation due to lack of prescribed fire. Its long-term prospects are favorable due to habitat acquisition after it was listed, as well as efforts by conservation land managers to restore natural fire regimes. It is now the most abundant of the "rare" species at the Tiger Creek Preserve and populations are stable, so it does not receive intensive monitoring (Pace-Aldana 2005). There is still some degree of threat from ongoing conversion of the remaining small fragments of sandhill (high pineland) and turkey oak scrub for agricultural, commercial, and residential purposes. Recreational motorized off-road vehicles have the potential to severely impact scrub buckwheat, but conservation lands on the LWR with scrub buckwheat generally do not have vehicle management problems. Several other endangered or threatened plants occur in turkey oak scrub with scrub buckwheat, notably pygmy fringe tree, pigeon wings, Carter's mustard, and Lewton's polygala (Christman 1988).

Scrub buckwheat occurs in the following counties:

- Putnam (Wunderlin and Hansen 2005) – no specific information is available, but the county has extensive sandhill vegetation, including some on conservation lands;
- Marion – relatively abundant in parts of the Ocala National Forest, with up to 71 localities reported (Service 1996);

- Pasco – sandhill area within the Green Swamp property of the South Florida Water Management District (SFWMD) (Service 1996). The report by a SFWMD employee, has not been confirmed with a herbarium specimen;
- Hillsborough – reported by the 1996 recovery plan, apparently in error (not attributed to this county by Wunderlin and Hansen [2005]);
- Lake – probably still present in sandhill vegetation remnants near Clermont (Service 1996), formerly near Lake Eustis (Herbarium specimen G.V. Nash 704, May 1, 1894, Gray Herbarium, Harvard University). It is present on the 120-acre Flat Lake tract of Seminole State Forest in Lake County southeast of Clermont (Schultz *et al.* 1999; FNAI 2005), which was purchased by The Nature Conservancy in 1999 (Finkelstein 1999);
- Seminole (Wunderlin and Hansen 2005) – no further information is available on this urban county;
- Orange – southwest corner of county. Collected by S. Christman in 1987 (University of Florida herbarium catalog);
- Osceola – northwest corner of county. Collected in 1991 by Angus K. Gholsen in a "planted slash pine area with a native sandhill understory with *Prunus geniculata* (scrub plum) and *Nolina brittoniana* (Britton's beargrass) (University of Florida herbarium specimen catalog);
- Polk – on conservation lands at the Arbuckle, Lake Walk-in-the-Water, and Babson-Hesperides tracts of LWR State Forest, Allen David Broussard Catfish Creek Preserve State Park, The Nature Conservancy Tiger Creek Preserve, the Carter Creek tract of LWR NWR, Pine Ridge nature preserve at the Historic Bok Sanctuary, Lake Davenport, and SFWMD Horse Creek Scrub; and
- Highlands – on conservation lands at the Lake Apthorpe tract of the LWR Wildlife and Environmental Area, Flamingo Villas tract of LWR NWR, and Archbold Biological Station, which represents its southern range limit. Also present in the Avon Park Lakes area (Schultz *et al.* 1999).

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Status of the Species – scrub mint
U.S. Fish and Wildlife Service
October 2010

STATUS OF THE SPECIES - Scrub mint (*Dicerandra frutescens*)

Scrub mint was federally listed as an endangered species on November 1, 1985 (56 FR 56882, Service 1985). Critical habitat has not been designated. The species is listed as endangered by the State of Florida. In addition to the assessment below, a 5-year review was completed in 2009 resulting in no change to the species designation as endangered (Service 2009). No critical habitat has been designated for this species. The 5-year review builds upon the detailed information in the Multi Species Recovery Plan (MSRP; Service 1999) and is located at http://www.fws.gov/southeast/5yearReviews/5yearreviews/ScrubMint-20090807.pdf

Species/Critical Habitat Description

Scrub mint, a member of the Lamiacaeae (mint family), is a partially woody, short-lived (less than 10 years), low-growing perennial shrub growing to 50 centimeters (cm) [20 inches (in)] in height. It grows from a deep, stout, spreading taproot. Its branches are mostly spreading, and sometimes prostrate. Its leaves are narrowly oblong-elliptic, linear-elliptic, or linear-oblanceolate, 1.5 to 2.5 cm (0.6 to 1.0 in) long, 2 to 3 millimeters (mm) (0.08 to 0.1 in) wide, narrowly or broadly rounded at the apical end, with entire margins. The leaves produce a strong odor of menthol when crushed. The flowers are clustered just above paired leaves are on short stalks (cymes), each containing 1 to 3 flowers. They are white or yellowish-white, 2.0 cm (0.8 in) long, with the upper lip marked with a trellis pattern of lines and dots of deep purple, while the lower lip has larger, concentric spots. The corolla is funnel shaped and abruptly bent to about 90 degrees. The upper lobe is a recurving, cleft standard, and the lower lobe is tripartite (three parted) with a recurving middle petal. The flowers have four paired stamens that are exerted slightly beyond the lower corolla lip. The filaments are white with purple anthers. The pistil is white and has a slender, fuzzy style. The fruit is a schizocarp of four ovoid, brown, smooth seeds (Kral 1983, Huck 1987).

Scrub mint is very similar in appearance to its closely related congener Garrett's mint (*D. christmanii*), but can be distinguished by anther color, odor, leaf length, and chemistry of the compounds found in leaves (Huck *et al*. 1989).

Scrub mint is endemic to the Lake Wales Ridge (LWR) and occurs only in Polk and Highlands County, Florida (Huck 2008). Habitat for scrub mint is yellow sand soil types in scrub vegetation (Menges 1992). Populations occur in both sand pine scrub and oak-hickory scrub. Most populations are found in areas with excessively well-drained Astatula and Paola yellow sands (Menges 1992). These soils support scrub and sandhill vegetation, but have largely been converted to citrus cultivation (Menges 1992).

Within the habitats where it occurs, scrub mint prefers open microsites (Menges *et al*. 1999; Menges 1992). The microhabitat supporting it was found to have less litter cover, less litter depth, and less shrub and tree cover than sites where it was absent. Scrub mint tended to occupy

areas with shallow leaf litter [less than 2 cm (0.8 in)] and with partial to no canopy cover. It also occurs in areas with regular small-scale soil disturbance such as foot trails and abandoned fire roads (Menges 1992).

Life History

Seedlings of scrub mint typically emerge in the winter. After 1 to 2 years of growth, plants will produce flowers July through November, peaking in September through October. Temporary flowering shoots are produced, bearing abundant flowers. These stems die during the winter dry season. Seed production occurs through the fall. The basal parts of the plants are perennial and maintain leaves year-round.

Scrub mint is not an obligate out-crosser; it is self-compatible (Evans *et al*. 2004 *contra* Huck 1987). Scrub mint is insect pollinated and requires insect visits for seed production (Evans *et al.* 2004). *Exprosopa fasciata* (Diptera: Bombyliidae), a bee-fly is the dominant pollinator, accounting for 95 percent of all visits (Deyrup and Menges 1997). Bee-flies are common and abundant generalist pollinators.

Scrub mint fruit and seed dispersal is limited to a few meters from the parent plant. No specialized mechanism for animal mediated dispersal has been identified (Menges *et al*. 2001).

Population Dynamics

Twenty years of demographic data have been collected for scrub mint at Archbold Biological Station. Annual mortality rates are high (greater than 20 percent) in the populations studied (Menges *et al.* 1999). Most mortality occurs during the dry, hot spring typical of central Florida, suggesting that drought or temperature may have effects on survival. Annual seedling recruitment varies widely from year to year. A 'good' year may have 50 times the number of seedlings as a 'bad' year (Menges *et al*. 1999). High mortality and episodic seedling recruitment cause large annual fluctuations in populations and are linked, in part, to especially dry spring months (Menges 2008).

Scrub mint populations are dependent on fire for long-term persistence (Menges *et al.* 2006). Several studies have investigated the fire ecology of the species (Menges 1992; Menges *et al*. 2006; Evans *et al*. 2008). There is an inverse relationship between time-since-fire and multiple demographic and reproductive factors including mortality of adult plants, growth and maturation rates, plant fecundity, number of pollinator visits, and seedling recruitment. A population viability analysis (PVA) indicated that population growth rates decline below the replacement level of 1.0 (on average) in populations that remain unburned more than five years (Menges *et al.* 2006). Populations begin to decline six years after a fire (Menges et al. 2006; Evans *et al*. 2008). Most demographic parameters peak at 3 to 5 years post-fire, after which populations experience a long slow decline (Menges and Weekley 1999). The decline occurs because yellow sand scrubs become extremely dense after 30 years, crowding out scrub mint (Menges 1992). Individual scrub mint plants are killed by fire and the population must regenerate from its seed bank (Menges *et al*. 2006). However, fire opens shrub canopies and consumes litter, creating favorable microsites for seedling germination. There is strong evidence that fire can promote

seedling recruitment in populations that were previously declining (Menges and Weekley 1999). Time-since-fire also has important effects on a population's ability to recover from fire via seeds present in the soil. Seed bank density was ten times lower at a site that had not been burned since 1926 than in two sites that had been burned more recently (Menges and Weekly 1999). Based on PVA modeling, Menges *et al.* (2006) recommended a fire return interval of 6 to 21 years in xeric oak scrub to maximize persistence of scrub mint populations.

Menges (1992) found that experimental mechanical defoliation of scrub mint plants resulted in 100 percent mortality. Herbivory does not have a strong effect on population dynamics and is probably not an important management consideration (Menges and Weekley 1999). Seed predators (Thyreocoridae: *Cynoides ciliatus* ssp. *orientis*) observed in capsules of scrub mint could be responsible for the lack of endosperm in some seeds, but their numbers are typically not great (Evans *et al.* 2004).

Status and Distribution

The loss of scrub on the LWR habitat was the primary reason for listing scrub mint as endangered (Service 1999). Scrub mint occurs in Highlands County, Florida. It was historically distributed more or less contiguously along a high yellow-sand ridge that has only been fragmented within the last 40 to 60 years (Menges *et al.* 2001). Populations now occur discontinuously across the species range since suitable habitat has a patchy distribution and is now increasingly fragmented by development. Where found, however, scrub mint plants can occur in locally dense concentrations. Smaller populations observed at some sites may be partly a consequence of fire suppression and may not be typical of historical abundance patterns (Menges *et al.* 2001).

There are 14 known occurrences of scrub mint (FNAI 2008). Three are confirmed to be extirpated because the sites have been developed and no suitable habitat or plants remain (Bok Tower Garden 2010). Five of the 11 remaining occurrences are within two protected areas - Archbold Biological Station (private ownership; more than 500 plants) and Lake Wales Ridge Wildlife and Environmental Area (LWRWEA) Highland Park Estates tract (State-owned; only 8 to 10 plants in 2009) (Bok Tower Gardens 2010).

Six occurrences are located on unprotected private land. In 2010, three of the sites had no plants present in the areas surveyed, but suitable habitat remained and surveys were incomplete due to lack of access to private parcels. Three occurrences on private land were confirmed to be extant in 2010, with two being large populations (estimated at 4,093 and 1,234 plants), and a third, smaller population (53 plants) (Bok Tower Gardens 2010).

Threats

Habitat destruction from development continues to occur and development pressure remains high. Turner *et al.* (2006) estimated that 87 percent of upland habitat has been lost on the LWR by 2006. Increasing pressure from population growth is likely to result in further loss of LWR habitats. Zwick and Carr (2006) predicted central Florida will experience "explosive" growth over the next 50 years. They estimated 2.7 million acres of native habitat and 630,000 acres of

land currently under consideration for conservation purchase will be lost. Even if all lands targeted for conservation are acquired (an unlikely scenario), this would still only represent 7.5 percent of the xeric upland habitats that existed on the LWR prior to widespread human settlement (Turner *et al*. 2006).

Fire suppression started on a regional scale on the LWR about 70 years ago. In long-unburned sites, population growth rates are negative, suggesting continued population decline (Menges *et al.* 2006). However, reintroducing fire to long-unburned sites presents complications for species recovery. Areas with excessive fuel loads may burn hot and complete, requiring scrub mint to regenerate entirely from the seed bank. However, recent seed production may be low in overgrown sites. Fuel reduction treatment of shrubs around patches of scrub mint could allow for patchier burns and survival of some existing plants and improve post-fire regeneration (Evans *et al.* 2004).

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