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DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS–R4–ES–2015–0164]

[4500030113]

RIN 1018–BA16

Endangered and Threatened Wildlife and Plants; 90-day and 12-month Findings on a Petition to List the Miami Tiger Beetle as an Endangered or Threatened Species; Proposed Endangered Species Status for the Miami Tiger Beetle

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Proposed rule; notice of 90-day and 12-month findings.

SUMMARY: We, the U.S. Fish and Wildlife Service (Service), propose to list the Miami tiger beetle (*Cicindelidia floridana*) as an endangered species throughout its range under the Endangered Species Act of 1973, as amended (Act). If we finalize this rule as

proposed, it would extend the Act's protections to this species.

This document also serves as the 90-day and 12-month findings on a petition to list the species as an endangered or threatened species.

DATES: ***Written Comments*****:** We will accept comments received or postmarked on or before [INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]. Comments submitted electronically using the Federal eRulemaking Portal (see **ADDRESSES**, below) must be received by 11:59 p.m. Eastern Time on the closing date. We have scheduled a public hearing for January 13, 2016 (see *Public Hearing*, below).

ADDRESSES: You may submit comments by one of the following methods:

(1) *Electronically*: Go to the Federal eRulemaking Portal: *http://www.regulations.gov*. In the Search box, enter FWS–R4–ES–2015–0164, which is the docket number for this rulemaking. Then, in the Search panel on the left side of the screen, under the Document Type heading, click on the Proposed Rules link to locate this document. You may submit a comment by clicking on "Comment Now!"

(2) *By hard copy*: Submit by U.S. mail or hand-delivery to: Public Comments Processing, Attn: FWS–R4–ES–2015–0164, U.S. Fish and Wildlife Service, MS: BPHC, 5275 Leesburg Pike, Falls Church, VA 22041-3803.

We request that you send comments only by the methods described above. We will post all comments on *http://www.regulations.gov*. This generally means that we will post any personal information you provide us (see *Public Comments*, below, for more information).

(3) *Public Hearing*: Comments received at the public hearing held on January 13, 2016 at Miami Dade College - Kendall Campus, Building 6000, 11011 SW 104th Street, Miami, Florida 33176-3396 from 6:00 p.m. to 9:00 p.m.

FOR FURTHER INFORMATION CONTACT: Roxanna Hinzman, Field Supervisor, U.S. Fish and Wildlife Service, South Florida Ecological Services Office, 1339 20th Street, Vero Beach, FL 32960; by telephone 772–562–3909; or by facsimile 772–562–4288. Persons who use a telecommunications device for the deaf (TDD) may call the Federal Information Relay Service (FIRS) at 800–877–8339.

SUPPLEMENTARY INFORMATION

Executive Summary

Why we need to publish a rule. Under the Act, if we determine that a species is an endangered or threatened species throughout all or a significant portion of its range, we must publish a proposed rule to list the species in the **Federal Register** and make a determination on our proposal within 1 year. Listing a species as an endangered or threatened species can only be completed by issuing a rule.

This rule proposes the listing of the Miami tiger beetle (*Cicindelidia floridana*) as an endangered species. This rule assesses all available information regarding the status of and threats to the Miami tiger beetle.

The basis for our action. Under the Act, we may determine that a species is an endangered or threatened species based on any of five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. We have determined that the threats to the Miami tiger beetle consist of habitat loss, degradation, fragmentation, and proposed future development of habitat (Factor A); collection, trade, and sale (Factor B); inadequate protection from existing regulatory mechanisms (Factor D); and a small isolated population with a restricted geographical range, limited genetic exchange, and restricted dispersal potential that is subject to demographic and environmental stochasticity, including climate change and sea level rise (Factor E).

We will seek peer review. We will invite independent specialists (peer reviewers) to comment on our listing proposal to ensure that it is based on scientifically sound data, assumptions, and analyses.

Information Requested

Public Comments

We intend that any final action resulting from this proposed rule will be based on the best scientific and commercial data available and be as accurate and as effective as possible. Therefore, we request comments or information from other concerned governmental agencies, Native American tribes, the scientific community, industry, or any other interested parties concerning this proposed rule. We particularly seek comments concerning:

(1) The Miami tiger beetle's biology, range, population trends, and habitat, including:

(a) Biological or ecological requirements of the species, including habitat requirements for feeding, breeding, and sheltering;

(b) Taxonomy, including genetic information;

(c) Historical and current range, including distribution patterns and dispersal distances;

(d) Historical and current range or distribution, including the locations of any additional occurrences of the beetle, population levels, current and projected population trends, and viability;

(e) Past and ongoing conservation measures for the species, its habitat, or both;

(f) Survey methods appropriate to detect trends in tiger beetle population distribution and abundance; and

(g) The use of previously undocumented or altered habitat types (*e.g.*, use of road edges and fire breaks), especially in areas that may not be burned regularly.

(2) Factors that may affect the continued existence of the species, which may include habitat modification or destruction, overutilization (e.g., collection, sale, or trade), disease, predation, the inadequacy of existing regulatory mechanisms, or other natural or manmade factors.

(3) Biological, commercial trade, or other relevant data concerning any threats (or lack thereof) to the species and existing regulations that may be addressing those threats.

(4) Current or planned activities in the areas occupied by the species and possible impacts of these activities on the species.

(5) Overutilization for commercial, recreational, scientific, or educational purposes, including information regarding over-collection at permitted sites, evidence of collection or collection rates in general, and recreational or commercial trade and sale.

(6) The following specific information on:

(a) The amount and distribution of habitat for the Miami tiger beetle;

(b) Any occupied or unoccupied areas that are essential for the conservation of the species and why;

(c) Special management considerations or protections that may be needed for the essential features in potential critical habitat areas, including managing for the potential effects of climate change.

Please include sufficient information with your submission (such as scientific journal articles or other publications) to allow us to verify any scientific or commercial information you include.

Because we will consider comments and all other information we receive during the public comment period, our final determination may differ from this proposal.

Please note that submissions merely stating support for or opposition to the action under consideration without providing supporting information, although noted, will not be considered in making a determination, as section 4(b)(1)(A) of the Act (16 U.S.C. 1531 et seq.) directs that determinations as to whether any species is an endangered or threatened species must be made “solely on the basis of the best scientific and commercial data available.”

You may submit your comments and materials concerning this proposed rule by one of the methods listed in the **ADDRESSES** section. We request that you send comments only by the methods described in the **ADDRESSES** section.

If you submit information via *http://www.regulations.gov*, your entire submission—including any personal identifying information—will be posted on the website. If your submission is made via a hardcopy that includes personal identifying information, you may request at the top of your document that we withhold this information from public review. However, we cannot guarantee that we will be able to do so. We will post all hardcopy submissions on *http://www.regulations.gov*.

Comments and materials we receive, as well as supporting documentation we used in preparing this proposed rule, will be available for public inspection on *http://www.regulations.gov*, or by appointment, during normal business hours, at the U.S. Fish and Wildlife Service, South Florida Ecological Services Office (see **FOR FURTHER INFORMATION CONTACT**).

Public Hearing

Section 4(b)(5) of the Act provides for one or more public hearings on this proposal, if requested. A public hearing will be held on January 13, 2016 from 6:00 pm to 9:00 p.m. at Miami Dade College – Kendall Campus, Building 6000, 11011 SW 104th Street, Miami, Florida 33176-3396.

Peer Review

In accordance with our joint policy with the National Marine Fisheries Service on peer review published in the **Federal Register** on July 1, 1994 (59 FR 34270), we are seeking expert opinions of appropriate and independent specialists regarding this proposed rule. The purpose of peer review is to ensure that our proposed listing actions are based on scientifically sound data, assumptions, and analyses. The peer reviewers have expertise in insect biology, habitat, physical or biological factors, and so forth, which will inform our determination. We invite comment from these peer reviewers during this public comment period.

Previous Federal Actions

In 2013, we began assessing the status and threats to the Miami tiger beetle and considering the need to add the beetle to the List of Endangered and Threatened Wildlife. On December 11, 2014, we received a petition from the Center for Biological Diversity (CBD), the Miami Blue Chapter of the North American Butterfly Association, South Florida Wildlands Association, Tropical Audubon Society, Sandy Koi, Al Sunshine, and Chris Wirth requesting that the Miami tiger beetle be emergency listed as endangered, and that critical habitat be designated under the Act (CBD *et. al*. 2014, entire). The petition clearly identified itself as such and included the requisite identification information for the petitioner, as required by title 50 of the Code of Federal Regulations (CFR) at section 424.14(a) (50 CFR 424.14(a)). In a February 13, 2015, letter to the petitioners, we acknowledged receipt of the petition and stated that although we determined that emergency listing was not warranted, we would review the petitioned request for listing. The Service's review concluded that listing was warranted, and that we should proceed in an expeditious manner with the proposed listing of the species under the Act. Therefore, this document also constitutes, in addition to the proposed listing, both our 90-day and 12-month findings on the petition to list the Miami tiger beetle.

Background

Species Description

The Miami tiger beetle is an elongate beetle with an oval shape and bulging eyes, and is one of the smallest (6.5–9.0 millimeters (mm) (0.26–0.35 inches (in))) tiger beetles in the United States (Knisley 2015a, p. 3; 2015b, p. 3). The underside of the abdomen is orange to orange-brown in color like many other *Cicindelidia* species (Pearson 1988, p. 134; Knisley 2015a, p. 3; Knisley 2015b, p. 3). The Miami tiger beetle is uniquely identified by the shiny dark green dorsal surface, sometimes with a bronze cast and, without close examination in the field, may appear black; the pair of green hardened forewings covering the abdomen (elytra) have reduced white markings (maculations) consisting only of a small patch at the posterior tip of each elytron (Brzoska *et al*. 2011, pp. 2–6).

As is typical of other tiger beetles, adult Miami tiger beetles are active diurnal predators that use their keen vision to detect movement of small arthropods and run quickly to capture prey with their well-developed jaws (mandibles). Observations by various entomologists indicate small arthropods, especially ants, are the most common prey for tiger beetles. Choate (1996, p. 2) indicated ants were the most common prey of tiger beetles in Florida. Willis (1967, pp. 196–197) lists over 30 kinds of insects from many families as prey for tiger beetles, and scavenging is also common in some species (Knisley and Schultz 1997, pp. 39, 103).

Tiger beetle larvae have an elongate, white, grub-like body and a dark or metallic head with large mandibles. Larvae are sedentary sit-and-wait predators occurring in permanent burrows flush with the ground surface (Essig 1926, p. 372; Essig 1942, p. 532; Pearson 1988, pp. 131–132). When feeding, larvae position themselves at the burrow mouth and quickly strike at and seize small arthropods that pass within a few centimeters (cm) of the burrow mouth (Essig 1942, pp. 531-532; Pearson 1988, p. 132). An enlarged dorsal portion of the fifth abdominal segment, with two pairs of hooks, anchors the larvae into its permanent burrow while the upper portion of the body extends to capture prey (Pearson 1988, p. 127; Choate 1996, p. 2). Larvae prey on small arthropods, similar to adults.

Taxonomy

The Miami tiger beetle (*Cicindelidia floridana* Cartwright) is a described species in the Subfamily Cicindelinae of the Family Carabidae (ground beetles). Previously, tiger beetles were considered a separate family, but are now classified as a subfamily of the family Carabidae on the basis of recent genetic studies and other characters (Bousquet 2012, p. 30). The Miami tiger beetle is in the *C. abdominalis* group that also includes the eastern pinebarrens tiger beetle (*C. abdominalis*), scrub tiger beetle (*C. scabrosa*), and Highlands tiger beetle (*C. highlandensis*). New treatments of tiger beetles (Bousquet 2012, p. 30; Pearson *et al.* 2015, p. 138) have also elevated most of the previous subgenera of tiger beetles to genera, resulting in a change of the genus of the tiger beetles in the *C. abdominalis* group from *Cicindela* to *Cicindelidia*. These genera were originally proposed by Rivalier (1954, entire) and are widely used by European scientists (Wiesner 1992, entire), but are considered subgenera by many American scientists. The return to Rivalier's system has also been supported by a new study using genetic evidence (Duran and Gwiazdowski, in preparation).

The four species in the *Cicindelidia abdominalis* group all share a small body size (7–11 mm (0.28–0.43 in) long) and orange underside, and they occur in inland sandy habitats. The four beetles maintain separate ranges along the U.S. east coast and exhibit a significant gradient in range size: The eastern pinebarrens tiger beetle occurs from New York south along the coastal plain to north Florida; the scrub tiger beetle is present throughout much of peninsular Florida, south to Ft. Lauderdale; the Highlands tiger beetle is restricted to the Lake Wales Ridge of Highlands and Polk Counties, Florida; and the Miami tiger beetle is found only in Miami-Dade County, Florida.

The Miami tiger beetle was first documented from collections made in 1934, by Frank Young (see *Distribution*, below). There were no observations after this initial collection, and the species was thought to be extinct until it was rediscovered in 2007, at the Zoo Miami Pine Rockland Preserve in Miami-Dade County. The rediscovery of a Miami tiger beetle population provided additional specimens to the 1934 collection and prompted a full study of its taxonomic status, which elevated it to a full species, *Cicindelidia floridana* (Brzoska *et al.* 2011, entire).

The Miami tiger beetle is distinguished from the three other species of the *abdominalis* group based on: (1) Morphology (color, maculation (spots or markings), and elytral (modified front wing) microsculpture); (2) distribution; (3) habitat requirements; and (4) seasonality (Brzoska *et al*. 2011, entire; Bousquet 2012, p. 313; Pearson *et al.* 2015, p. 138). This array of distinctive characters is comparable to the characters used to separate the other three species of the *C. abdominalis* group.

Although color is often variable and problematic as a sole diagnostic trait in tiger beetles, it is useful when combined with other factors (Brzoska *et al*. 2011, p. 4). In comparison with the closely related scrub tiger beetle, the Miami tiger beetle has a green or bronze-green elytra, rarely with a post median marginal spot, and without evidence of a middle band, while the scrub tiger beetle has a black elytra, with a post median marginal spot, usually with a vestige of a middle band (Brzoska *et al*. 2011, p. 6) (see

Brzoska *et al*. 2011 for detailed description, including key). There are also noticeable differences in the width of the apical lunule (crescent shape), with the Miami tiger beetle's being thin and the scrub tiger beetle's medium to thick.

In addition, the Miami tiger beetle has a narrower, restricted range where its distribution does not overlap with the other three species in the *C. abdominalis* group (*i.e.*, the Miami tiger beetle has only been documented in Miami-Dade County). The Miami tiger beetle also occupies a unique habitat type (*i.e.*, pine rockland versus scrub or open sand and barren habitat).

Lastly, the Miami tiger beetle has a broader period of adult activity than the "late spring to mid-summer" cycle that is observed in the scrub tiger beetle (Brzoska *et al*. 2011, p. 6) (see also *Distribution*, *Habitat*, and *Biology* sections, below). Adult Miami tiger beetles have been observed from early May through mid-October; this is an unusually long flight period that suggests either continual emergence or two emergence periods (Brzoska *et al*. 2011, p. 6). In summary, the Miami tiger beetle is recognized as a distinct full species, based upon its differences in morphology, distribution, habitat, and seasonality (Brzoska *et al*. 2011, entire; Bousquet 2012, p. 313; Pearson *et al.* 2015, p. 138).

Genetic analyses for the Miami tiger beetle to date are limited to one nonpeer-reviewed study, and available techniques (*e.g.*, genomics, which can better study the process of speciation) are evolving. A limited genetic study using mitochondrial DNA (mtDNA) suggested that the eastern pinebarrens tiger beetle, Highlands tiger beetle, scrub tiger beetle, and Miami tiger beetle are closely related and recently evolved

(Knisley 2011a, p. 14). As with other similar *Cicindela* groups, these three sister species were not clearly separable by mtDNA analysis alone (Knisley 2011a, p. 14). The power of DNA sequencing for species resolution is limited when species pairs have very recent origins, because in such cases new sister species will share alleles for some time after the initial split due to persistence of ancestral polymorphisms, incomplete lineage sorting, or ongoing gene flow (Sites and Marshall 2004, pp. 216–221; McDonough *et al*. 2008, pp. 1312–1313; Bartlett *et al*. 2013, pp. 874–875). Changing sea levels and coincidental changes in the size of the land mass of peninsular Florida during the Pleistocene Era (2.6 million years ago to 10,000 years ago) is thought to be the key factor in the very recent evolutionary divergence and speciation of the three Florida species from *C. abdominalis* (Knisley 2015a, p. 5; Knisley 2015b, p. 4). Despite the apparent lack of genetic distinctiveness from the one non peer-reviewed, limited genetic study, tiger beetle experts and peer-reviewed scientific literature agree that based on the morphological uniqueness, geographic separation, habitat specialization, and extended flight season, the Miami tiger beetle warrants species designation (Brzoska *et al*. 2011, entire; Bousquet 2012, p. 313; Pearson *et al.* 2015, p. 138).

The most current peer-reviewed scientific information confirms that *Cicindelidia floridana* is a full species, and this taxonomic change is used by the scientific community (Brzoska *et al*. 2011, entire; Bousquet 2012, p. 313; Pearson *et al.* 2015, p. 138; Integrated Taxonomic Information System (ITIS), 2015, p. 1). One source researched for the Miami tiger beetle's taxonomic designation is the ITIS, which was created by a White House Subcommittee on Biodiversity and Ecosystem Dynamics to provide scientifically credible taxonomic information and standardized nomenclature on species. The ITIS is partnered with Federal agencies, including the Service, and is used by agencies as a source for validated taxonomic information. The ITIS recognizes the Miami tiger beetle as a valid species (ITIS, 2015, p. 1). Both the ITIS (2015, p. 1) and Bousquet (2012, p. 313) continue to use the former genus, *Cicindela* (see discussion above). The Florida Natural Areas Inventory (FNAI) (2015, p. 16) and NatureServe (2015, p. 1) also accept the Miami tiger beetle's taxonomic status as a species and use the new generic designation, *Cicindelidia*. In summary, although there is some debate about the appropriate generic designation (*Cicindelidia* versus *Cicindela*) based upon the best available scientific information, the Miami tiger beetle is a valid species.

Distribution

Historical Range

The historical range of the Miami tiger beetle is not completely known, and available information is limited based on the single historical observation prior to the species' rediscovery in 2007. It was initially documented from collections made in 1934, by Frank Young within a very restricted range in the northern end of the Miami Rock Ridge, in a region known as the Northern Biscayne Pinelands. The Northern Biscayne Pinelands, which extend from the city of North Miami south to approximately SW 216th Street, are characterized by extensive sandy pockets of quartz sand, a feature that is necessary for the Miami tiger beetle (see *Habitat* section, below) (Service 1999, p. 3-

162). The type locality (the place where the specimen was found) was likely pine rockland habitat, though the species is now extirpated from the area (Knisley and Hill 1991, pp. 7, 13; Brzoska *et al*. 2011, p. 2; Knisley 2015a, p. 7). The exact location of the type locality in North Miami was determined by Rob Huber, a tiger beetle researcher who contacted Frank Young in 1972. Young recalled collecting the type specimens while searching for land snails at the northeast corner of Miami Avenue and Gratigny Road (119th Street), North Miami. Huber checked that location the same year and found that a school had been built there. A more thorough search for sandy soil habitats throughout that area found no potential habitat (Knisley and Hill 1991, pp. 7, 11–12). Although the contact with Young did not provide habitat information for the type locality, a 1943 map of habitats in the Miami area showed pine rockland with sandy soils reaching their northern limit in the area of the type locality (Knisley 2015a, p. 27), and Young's paper on land snails made reference to pine rockland habitat (Young 1951, p. 6). Recent maps, however, show that the pine rockland habitat has been mostly developed from this area, and remaining pine rockland habitat is mostly restricted to Miami-Dade County owned sites in south Miami (Knisley 2015a, p. 7). In summary, it is likely that the Miami tiger beetle historically occurred throughout pine rockland habitat on the Miami Rock Ridge.

Current Range

The Miami tiger beetle was thought to be extinct until 2007, when a population was discovered at the Richmond Heights area of south Miami, Florida, known as the Richmond Pine Rocklands (Brzoska *et al*. 2011, p. 2; Knisley 2011a, p. 26). The

Richmond Pine Rocklands is a mixture of publically and privately owned lands that retain the largest area of contiguous pine rockland habitat within the urbanized areas of Miami-Dade County and outside of the boundaries of Everglades National Park (ENP). Surveys and observations conducted at Long Pine Key in ENP have found no Miami tiger beetles, and habitat conditions are considered unsuitable for the species (Knisley 2015a, p. 42; J. Sadle, 2015, pers. comm.). At this time, known extant occurrences are found on four contiguous sites of pine rockland habitat in the Richmond Pine Rocklands: (1) Zoo Miami Pine Rockland Preserve (Zoo Miami) (293 hectares (ha); 723 acres (ac)), (2) Larry and Penny Thompson Park (121 ha; 300 ac), (3) U.S. Coast Guard property (USCG) (96 ha; 237 ac), and (4) University of Miami's Center for Southeastern Tropical Advanced Remote Sensing property (CSTARS) (31 ha; 76 ac). Most recently (September 2015), Miami tiger beetles were found outside of and within approximately 5.0 km (3.1 mi) of the four Richmond Pine Rockland parcels listed above. Based on historical records, current occurrences, and habitat needs of the species (see *Habitat* section, below), the current range of the species is considered to be any pine rockland habitat (natural or disturbed) within the Miami Rock Ridge (Knisley 2015a, p. 7; CBD *et al*. 2014, pp. 13–16, 31–32).

The Miami tiger beetle is extremely rare and only known to occur in two separate locations within pine rockland habitat in Miami-Dade County. The Richmond population occurs on four contiguous parcels within the Richmond Pine Rocklands: Zoo Miami, Larry and Penny Thompson Park, CSTARS, and USCG. The second location, which was recently identified, is within approximately 5.0 km (3.1 mi) of the Richmond population and separated by urban development (D. Cook, 2015, pers. comm.).

Miami tiger beetles within the four contiguous occupied parcels in the Richmond population are within close proximity to each other. There are apparent connecting patches of habitat and few or no barriers (contiguous and border each other on at least one side) between parcels. Given the contiguous habitat with few barriers to dispersal, frequent adult movement among individuals is likely, and the occupied Richmond parcels probably represent a single population (Knisley 2015a, p. 10). Information regarding Miami tiger beetles at the new location is very limited, but beetles here are within approximately 5.0 km (3.1 mi) of the Richmond population and separated by ample urban development, which likely represents a significant barrier to dispersal, and the Miami tiger beetles at the new location are currently considered a second population.

The Richmond population occurs within an approximate 2 square kilometer (km^2) (494 ac) block, but currently much of the habitat is overgrown with vegetation, leaving few remaining open patches for the beetle. Survey data documented a decline in the number of open habitat patches, and Knisley (2015a, pp. 9–10) estimated that less than 10 percent of the mostly pine rockland habitat within this area supports the species in its current condition.

Habitat

Based on surveys to date, the Miami tiger beetle is found exclusively on the Miami Rock Ridge within the urbanized areas of Miami-Dade County and outside the boundaries of ENP (Knisley 2015a, pp. 6–7). This area extends from the ENP boundary, near the Park entrance road, northeast approximately 72 km (45 miles (mi)) to its end near North Miami. The pine rocklands are a unique ecosystem found on limestone substrates in three areas in Florida: the Miami Rock Ridge, the Florida Keys, and the Big Cypress Swamp. The pine rocklands differ to some degree between and within these three areas with regard to substrate (*e.g.*, amount of exposed limestone, type of soil), elevation, hydrology, and species composition (both plant and animal).

Pine rockland occurs on relatively flat terrain, approximately 2.0–7.0 m (6.5–23.0 ft) above sea level with an average elevation of approximately 3.0 m (9.8 ft) (Service 1999, p. 3-167; FNAI 2010, p. 62). On the Miami Rock Ridge, oolitic limestone is at or very near the surface, and solution holes occasionally form where the surface limestone is dissolved by organic acids. There is typically very little soil development, consisting primarily of accumulations of low-nutrient sand, marl, clayey loam, and organic debris found in solution holes, depressions, and crevices on the limestone surface (FNAI 2010, p. 62). However, sandy pockets can be found at the northern end of the Miami Rock Ridge, beginning from approximately the city of North Miami Beach and extending south to approximately to SW 216 Street (Service 1999, p. 3-162). These microhabitat parameters (*e.g*., bare patches of sandy soil) are absent or limited throughout most of the extant pine rockland habitat (URS *et al*. 2007, p. 5).

Pine rockland has an open canopy of South Florida slash pine, generally with multiple age classes. The diverse, open shrub and subcanopy layer is composed of more than 100 species of palms and hardwoods (FNAI 2010, p. 1), most derived from the tropical flora of the West Indies (FNAI 2010, p. 1). These vegetative layers and habitat conditions (*e.g*., canopy height, percent cover, density) change depending upon fire frequency, fire intensity, and other factors. Plant composition includes species such as *Serenoa repens* (saw palmetto), *Sabal palmetto* (cabbage palm), *Coccothrinax argentata* (silver palm), *Thrinax morrisii* (brittle thatch palm), *Morella cerifera*. (wax myrtle), *Myrsine floridana* (myrsine), *Metopium toxiferum* (poisonwood), *Byrsonima lucida* (locustberry), *Dodonaea viscosa* (varnishleaf), *Tetrazygia bicolor* (tetrazygia), *Guettarda scabra* (rough velvetseed), *Ardisia escallonioides* (marlberry), *Mosiera longipes* (mangrove berry), *Sideroxylon salicifolium* (willow bustic), and *Rhus copallinum* (winged sumac). Short-statured shrubs include *Quercus pumila* (running oak), *Randia aculeata* (white indigoberry), *Crossopetalum ilicifolium* (Christmas berry), *Morinda royoc* (redgal), and *Chiococca alba* (snowberry).

Grasses, forbs, and ferns make up a diverse herbaceous layer ranging from mostly continuous in areas with more soil development and little exposed rock to sparse where more extensive outcroppings of rock occur. Typical herbaceous species include *Andropogon* spp., *S. rhizomatum*, and *S. sanguineum* (bluestems), *Aristida purpurascens* (arrowleaf threeawn), *Sorghastrum secundum* (lopsided indiangrass), *Muhlenbergia capillaris* (hairawn muhly), *Rhynchospora floridensis* (Florida white-top sedge), *Tragia saxicola* (pineland noseburn), *Echites umbellatus* (devil's potato), *Croton linearis* (pineland croton), several species of *Chamaesyce* spp. (sandmats), *Chamaecrista fasciculata* (partridge pea), *Zamia pumila* (coontie), *Anemia adiantifolia* (maidenhair pineland fern), *Pteris bahamensis* (Bahama brake), and *Pteridium* var. *caudatum* (lacy bracken) (FNAI 2010, p. 1).

Pine rockland habitat is maintained by regular fire, and is susceptible to other natural disturbances such as hurricanes, frost events, and sea-level rise (SLR) (Ross *et al.* 1994, p. 144). Fires historically burned on an interval of approximately every 3 to 7 years (FNAI 2010, p. 3), and were typically started by lightning strikes during the frequent summer thunderstorms (FNAI 2010, p. 3).

Presently, prescribed fire must be periodically introduced into pine rocklands to sustain community structure, prevent invasion by woody species, maintain high herbaceous diversity (Loope and Dunevitz 1981, pp. 5–6; FNAI 2010, p. 3), and prevent succession to rockland hammock. The amount of woody understory growth is directly related to the length of time since the last fire (FNAI 2010, p. 3). Herbaceous diversity declines with time since the last fire. The ecotone between pine rockland and rockland hammock is abrupt when regular fire is present in the system. However, when fire is removed, the ecotone becomes more gradual and subtle as hammock hardwoods encroach into the pineland (FNAI 2010, p. 3).

The lifecycle of the Miami tiger beetle occurs entirely within the pine rocklands. Adult Miami tiger beetles require patches of open sandy areas within the pine rocklands for behavioral thermoregulation (avoiding or seeking sources of heat to regulate body temperature) so that they can successfully capture small arthropod prey (Knisley 2015a,

p. 8). They are visual hunters that use keen eyesight to locate and rapid movement to capture small arthropods. Females oviposit (lay eggs) in these same bare patches (Knisley 2015a, p. 8). The larvae, which are sit-and-wait predators, can capture prey and complete development in sandy areas, without interference from encroaching vegetation (Knisley 2015a, p. 8). At most of the remaining pine rockland sites on the Miami Rock Ridge, bare patches of sandy soil are absent or limited (URS *et al*. 2007, p. 5) (see "Microhabitat," below).

Microhabitat

Microhabitat conditions are not completely understood, due in part to few known occurrences and limited surveys at some parcels. At the Zoo Miami parcel, which was most thoroughly surveyed, adults and larvae were restricted to a small number of scattered patches of bare ground. The patches were small, typically 2 to 6 square meters (m^2) (22 to 65 square feet (ft^2)) in size and ovoid to linear in shape with encroaching and overhanging vegetation around the edges and with 15–30 percent ground cover of leaf, grass, and plant litter (Knisley 2015a, p. 8). Patches smaller than 2 to 6 m^2 (22–65 ft^2) typically had no adults (Knisley 2015a, p. 8). Some of the more linear patches were apparent current or past trails or paths, possibly maintained by animal activity. Soil in these open patches where adults and larvae were found was classified as sandy to loamy sand with primarily very fine (0.130 mm (0.005 in)) to medium grain (0.50 mm (0.02 in)), white to gray colored sand with less than 5 percent organic matter (Knisley 2011a, p. 32). Soil depth was 15.24 cm or more (6.00 in), and moist below the surface (Knisley

2015a, p. 8). This microhabitat is different from that used by either the Highlands or scrub tiger beetles, which in Florida are typically found in much larger, naturally open patches among the vegetation (usually greater than 25 m^2 (269 ft^2)) or along open paths, roads, and scrub edges (Knisley 2015a, p. 8). The sand for these other species is also white "sugar" sand, which is very deep, drier, and with less organic matter mixed in (Knisley 2015a, pp. 8–9).

Biology

In tiger beetles, the adult female determines the habitat and microhabitat of the larva by the selection of an oviposition (egg-laying) site (Knisley and Schultz 1997, p. 28). Generally, the same microhabitats are occupied by both larvae and adults. Females will often touch the soil with the antennae, bite it, and even dig trial holes, possibly to determine suitable soil characteristics (Willis 1967, p. 194) before placing a single egg into a shallow oviposition burrow (1 to 2 cm (0.39 to 0.79 in)) dug into the soil with the ovipositor. The egg hatches, apparently after sufficient soil wetting, and the first instar larvae digs a burrow at the site of oviposition. Development in tiger beetles includes three larval instars followed by a pupal and adult stage. In most species of tiger beetles, development requires 2 years, but can range from 1 to 4 or more years depending on climate and food availability. The life cycle of most tiger beetles in the United States follows either a summer or spring-fall adult activity pattern (Knisley and Schultz1997, pp. 19-21). These life cycles patterns all indicate the length of the adult flight season is typically 2 to 3 months, but the life span of individual adults is likely to be less.

Based on available information, the Miami tiger beetle appears to have only limited dispersal abilities. Among tiger beetles there is a general trend of decreasing flight distance with decreasing body size (Knisley and Hill 1996, p. 13). The Miami tiger beetle is one of the smallest tiger beetles (less than half an inch in length); it is likely to be a weak flier based on its size and the limited flight distance of the closely related Highlands tiger beetle (usually flying only 5–10 m (16.4–32.8 ft)) (Knisley and Hill 2013, p. 39). Additionally, tiger beetle species in woodland, scrub, or dune habitats seem to disperse less than water edge species, and this could further explain the apparent limited dispersal of the species (Knisley and Hill 1996, p. 13). Evidence for longer distance dispersal has been reported for some tiger beetle species, but these are generally larger, coastal species that occupy more widespread habitats and use frequent winds or coastal storms to aid in dispersal. For example, a dispersal distance of 160 km (99 mi) was reported for the s-banded tiger beetle (*Cicindelidia trifasciata*), a coastal mud flat species, that was found in light traps on offshore oil platforms in the Gulf of Mexico (Graves 1981, pp. 45–47). Similarly, extensive mark and recapture studies of the northeastern beach tiger beetle (*Cicindela dorsalis*), a water edge species approximately twice the size of the Miami tiger beetle, found that the majority of marked adults moved 2 km (1.2 mi) or less, but a few individuals moved over 15–30 km (9–19 mi), some of which required crossing open water (Service 1993, pp. 15–17). Dispersal by storms is unknown to occur in the Miami tiger beetle, and is unlikely to be a successful dispersal strategy as the species is only known to occur in a narrowly distributed habitat type (*i.e.*, remaining pine rocklands) that is interspersed among unsuitable habitat and mixed land uses within a restricted geographical range.

As a group, tiger beetles occupy ephemeral habitats where local extinction from habitat loss or degradation is common, so dispersal to establish new populations in distant habitat patches is a likely survival strategy for most species (Knisley 2015b, p. 10). Limited dispersal capabilities and other constraints (*e.g.*, few populations, limited numbers, and barriers created by intervening unsuitable habitat), however, can disrupt otherwise normal metapopulation dynamics and contribute to imperilment.

Results of monthly surveys at the Zoo Miami parcel in 2009, and additional late summer and fall surveys through 2014, indicated the adult flight period for the Miami tiger beetle ranges from May 15 through October 17 (Knisley 2015a, p. 5). No adults were found during an April 18 survey, meaning emergence had not yet occurred (Knisley 2015a, p. 6). In 2009, only two adults were found on September 2, either because conditions were not ideal (although they seemed to be suitable) or activity may have ended earlier in the year. In 2014, some adults were active on September 10 and 30, but not on October 14. This 5-month long adult flight period is unusual in tiger beetles and is much longer than the seasonality of the other three species in the *C. abdominalis* group with ranges in Florida (Knisley 2015a, p. 6).

There is no clear explanation for the long adult flight period of the Miami tiger beetle, but it is possible that there are two cohorts of Miami tiger beetle adults emerging during this period (Knisley 2015a, p. 6). Adults emerging in May and June would mate, oviposit, and produce larvae that could develop and emerge as a second cohort of adults in late July and August as the earlier cohort of adults were dying off. Larvae from these later active adults would develop through fall and winter, emerging as adults the following May. The rapid completion of development within 2 months would not be unusual given the small size of this species and the continually warm temperatures in south Florida (Knisley 2015a, p. 6). Rate of development is likely increased during the summer rainy season when prey is more abundant (Knisley 2015a, p. 6).

Population Estimates and Status

The visual index count is the standard survey method that has been used to determine presence and abundance of the Miami tiger beetle. Using this method, surveyors either walk slowly or stand still in appropriate open habitats, while taking a count of any beetle observations. Although the index count has been the most commonly used method to estimate the population size of adult tiger beetles, various studies have demonstrated it significantly underestimates actual numbers present. As noted earlier, several studies comparing various methods for estimating adult tiger beetle abundance have found numbers present at a site are typically 2 to 3 times higher than that produced by the index count (Knisley and Schultz 1997, p. 15; Knisley 2009, entire; Knisley and Hill 2013, pp. 27, 29; S. Spomer, 2014, pers. comm.). Numbers are underestimated because tiger beetles are elusive, and some may fly off before being detected while others may be obscured by vegetation in some parts of the survey area. Even in defined linear habitats like narrow shorelines where there is no vegetation and high visibility, index counts produce estimates that are 2 to 3 times lower than the numbers present (Knisley and Schultz 1997, p. 152).

Information on the Richmond population size is limited because survey data are inconsistent, and some sites are difficult to access due to permitting, security, and liability concerns. Of the occupied sites, the most thoroughly surveyed site for adult and larval Miami tiger beetles is the Zoo Miami parcel (over 30 survey dates from 2008 to 2014) (Knisley 2015a, p. 10). Adult beetle surveys at the CSTARS and USCG parcels have been infrequent, and access was not permitted in 2012 through early summer of 2014. In October 2014, access to both the CSTARS and USCG parcels was permitted, and no beetles were observed during October 2014 surveys. As noted earlier, Miami tiger beetles were recently found at Larry and Penny Thompson Park (D. Cook, 2015, pers. comm.); however, thorough surveys at this location have not been conducted. For details on index counts and larval survey results from the three surveyed parcels (Zoo Miami, USCG, and CSTARS), see Table 2 in *Supporting Documents* on *http://www.regulations.gov*.

Raw index counts found adults in four areas (Zoo A, Zoo B, Zoo C, and Zoo D) of the Zoo Miami parcel. Two of these patches (Zoo C and Zoo D) had fewer than 10 adults during several surveys at each. Zoo A, the more northern site where adults were first discovered, had peak counts of 17 and 22 adults in 2008 and 2009, but declined to 0 and 2 adults in six surveys from 2011 to 2014, despite thorough searches on several dates throughout the peak of the adult flight season (Knisley 2015, pp. 9–10). Zoo B, located south of Zoo A, had peak counts of 17 and 20 adults from 2008 to 2009, 36 to 42 adults from 2011 to 2012, and 13 and 18 adults in 2014 (Knisley 2015a, pp. 9–10). These surveys at Zoo A and Zoo B also recorded the number of suitable habitat patches (occupied and unoccupied). Surveys between 2008 and 2014 documented a decline in both occupied and unoccupied open habitat patches. Knisley (2015, pp. 9-10) documented a decrease at Zoo A from 7 occupied of 23 patches in 2008, to 1 occupied of 13 patches in 2014. At Zoo B, there was a decrease from 19 occupied of 26 patches in 2008, to 7 occupied of 13 patches in 2014 (Knisley 2015, pp. 9-10). Knisley (2015a, p. 10) suggested this decline in occupied and unoccupied patches is likely the result of the vegetation that he observed encroaching into the open areas that are required by the beetle.

At the CSTARS site, the only survey during peak season was on August 20, 2010, when much of the potential habitat was checked. This survey produced a raw count of 38 adults in 11 scattered habitat patches, with 1 to 9 adults per patch, mostly in the western portion of the site (Knisley 2015a, p. 10). Three surveys at the USCG included only a portion of the potential habitat and produced raw adult counts of two, four, and two adults in three separate patches from 2009, 2010, and 2011, respectively (Knisley 2015a, p. 10). Additional surveys of the CSTARS and the USCG parcels on October 14 to 15, 2014, surveyed areas where adults were found in previous surveys and some new areas; however, no adults were observed. The most likely reasons for the absence of adults were because counts even during the peak of the flight season were low (thus detection would be lower off-peak), and mid-October is recognized as the end of the flight season

(Knisley 2014a, p. 2). As was noted for the Zoo Miami sites, habitat patches at the CSTARS and USCG parcels that previously supported adults seemed smaller due to increased vegetation growth, and consequently these patches appeared less suitable for the beetle than in the earlier surveys (Knisley 2015a, p. 10).

Surveys of adult numbers over the years, especially the frequent surveys in 2009, did not indicate a bimodal adult activity pattern (Knisley 2015a, p. 10). Knisley (2015a, p. 10) suggests that actual numbers of adult Miami tiger beetles could be 2 to 3 times higher than indicated by the raw index counts. Several studies comparing methods for estimating population size of several tiger beetle species, including the Highlands tiger beetle, found total numbers present were usually more than two times that indicated by the index counts (Knisley and Hill 2013, pp. 27–28). The underestimates from raw index counts are likely to be comparable or greater for the Miami tiger beetle, because of its small size and occurrence in small open patches where individuals can be obscured by vegetation around the edges, making detection especially difficult (Knisley 2015a, p. 10).

Surveys for larvae at the Zoo Miami parcel (Zoos A and B) were conducted in several years during January when lower temperatures would result in a higher level of larval activity and open burrows (Knisley and Hill 2013, p. 38) (see Table 2 in *Supporting Documents* on *http://www.regulations.gov*). The January 2010 survey produced a count of 63 larval burrows, including 5 first instars, 36 second instars, and 22 third instars (Knisley 2013, p. 4). All burrows were in the same bare sandy patches where adults were found. In March 2010, a followup survey indicated most second instar larvae had progressed to the third instar (Knisley 2015a, p. 11). Additional surveys to determine larval distribution and relative abundance during January or February in subsequent years detected fewer larvae in section Zoo B: 5 larvae in 2011, 3 larvae in 2012, 3 and 5 larvae in 2013, 3 larvae in 2014, and 15 larvae in 2015 (Knisley 2013, pp. 4–5; Knisley 2015c, p. 1). The reason for this decline in larval numbers (i.e., from 63 in 2010, to 15 or fewer in each survey year from 2011 to 2015) is unknown. Possible explanations are that fewer larvae were present because of reduced recruitment by adults from 2010 to 2014, increased difficulty in detecting larval burrows that were present due to vegetation growth and leaf litter, environmental factors (*e.g.*, temperature, precipitation, predators), or a combination of these factors (Knisley 2015a, pp. 10–11). Larvae, like adults, also require open patches free from vegetation encroachment to complete their development. The January 2015 survey observed vegetation encroachment, as indicated by several of the numbered tags marking larval burrows in open patches in 2010 covered by plant growth and leaf litter (Knisley 2015c, p. 1). No larvae were observed in the January 2015 survey of Zoo A (Knisley 2015c, p.1). Knisley (2015d, p. 3) reported that the area had been recently burned (mid-November) and low vegetation was absent, resulting in mostly bare ground with extensive pine needle coverage.

Surveys for the beetle's presence outside of its currently known occupied range found no Miami tiger beetles at a total of 42 sites (17 pine rockland sites and 25 scrub sites) throughout Miami-Dade, Broward, Palm Beach, and Martin Counties (Knisley 2015a, pp. 9, 41-45). The absence of the Miami tiger beetle from sites north of Miami-Dade was probably because it never ranged beyond pine rockland habitat of Miami-Dade

County and into scrub habitats to the north (Knisley 2015a, p. 9). Sites without the Miami tiger beetle in Miami-Dade County mostly had vegetation that was too dense and were lacking the open patches of sandy soil that are needed by adults for oviposition and larval habitat (Knisley 2015a, pp. 9, 41–45).

The Miami tiger beetle is considered as one of two tiger beetles in the United States most in danger of extinction (Knisley *et al*. 2014, p. 93). The viability of the remaining population is unknown, as no population viability analysis is available (B. Knisley, 2015d, pers. comm.). The Florida Fish and Wildlife Conservation Commission (FWC) (2012, p. 89) regarded it as a species of greatest conservation need. The Miami tiger beetle is currently ranked S1 and G1 by the FNAI (2015, p.16), meaning it is critically imperiled globally because of extreme rarity (5 or fewer occurrences, or fewer than 1,000 individuals) or because of extreme vulnerability to extinction due to some natural or manmade factor.

In summary, the overall population size of the Miami tiger beetle is exceptionally small and viability is uncertain. Based upon the index count data to date, it appears that the two populations exist in extremely low numbers (Knisley 2015a, pp. 2, 10–11, 24).

Summary of Factors Affecting the Species

Section 4 of the Act (16 U.S.C. 1533), and its implementing regulations at 50 CFR part 424, set forth the procedures for adding species to the Federal Lists of Endangered and Threatened Wildlife and Plants. Under section 4(a)(1) of the Act, we may list a species based on any of the following five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; and (E) other natural or manmade factors affecting its continued existence. Listing actions may be warranted based on any of the above threat factors, singly or in combination. Each of these factors is discussed below.

Factor A. The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range

The Miami tiger beetle is threatened by habitat loss and modification caused by changes in land use and inadequate land management, including the lack of prescribed burns and vegetation (native and nonnative) encroachment (discussed separately below). Habitat loss and modification are expected to continue and increase, affecting any populations on private lands as well as those on protected lands that depend on management actions (*i.e.*, prescribed fire) where these actions could be precluded by surrounding development.

Habitat Loss

The Miami tiger beetle has experienced substantial destruction, modification, and curtailment of its habitat and range (Brzoska *et al.* 2011, pp. 5–6; Knisley 2013, pp. 7-8; Knisley 2015a, p. 11). The pine rockland community of south Florida, on which the beetle depends, is critically imperiled globally (FNAI 2013, p. 3). Destruction of the pinelands for economic development has reduced this habitat by 90 percent on mainland south Florida (O'Brien 1998, p. 208). Outside of ENP, only about 1 percent of the Miami Rock Ridge pinelands have escaped clearing, and much of what is left is in small remnant blocks isolated from other natural areas (Herndon 1998, p. 1).

The two known populations of the Miami tiger beetle occur within the Richmond Pine Rocklands, on parcels of publicly or privately owned lands that are partially developed, yet retain some undeveloped pine rockland habitat. In the 1940s, the Naval Air Station Richmond was built largely on what is currently the Zoo Miami parcel. Much of the currently occupied Miami tiger beetle habitat on the Zoo Miami parcel was scraped for the creation of runways and blimp hangars (Wirth 2015, entire). The fact that this formerly scraped pine rockland area now provides suitable habitat for the Miami tiger beetle demonstrates the restoration potential of disturbed pine rockland habitat (Possley 2015, entire; Wirth 2015, entire).

Any current known or unknown, extant Miami tiger beetle populations or potentially suitable habitat that may occur on private lands or non-conservation public lands, such as elsewhere within the Richmond Pine Rocklands or surrounding pine rocklands, are vulnerable to habitat loss. Miami-Dade County leads the State in gross urban density at 15.45 people per acre (Zwick and Carr 2006, pp. 1, 13), and development and human population growth are expected to continue in the future. By 2025, Miami-Dade County is predicted to exceed a population size of over 3 million people (Zwick and Carr 2006, p. 20). This predicted economic and population growth will further increase demands for land, water, and other resources, which will undoubtedly impact the survival and recovery of the Miami tiger beetle.

Remaining habitat is at risk of additional losses and degradation. Of high and specific concern are proposed development projects within the Richmond Pine Rocklands (CBD *et al*. 2014, pp. 19-24). In 2013, plans for potential development on portions of the Zoo Miami and USCG parcels were announced in local newspapers (Munzenrieder 2013, entire) and subsequently advertised through other mechanisms (*https://www.miamidade.gov/dpmww/SolicitationDetails.aspx?Id=Invitation%20To%20Negotiat e%20(ITN)* [accessed April 24, 2014]). The proposed development is to include the following: Theme park rides; a seasonally opened water park; a 400-room hotel with a Sony Music Theatre performance venue; a 30,000-ft^2 (2,787-m^2) retail and restaurant village; an entertainment center with movie theaters and bowling; an outdoor area for sports; a landscaped pedestrian and bike path; parking; and a 2.4-km (1.5-mi) transportation link that unifies the project's parts (Dinkova 2014a, p.1). The proposed development will require at least a portion of the USCG parcel, which would occur through purchase or a land swap (Dinkova 2014b, p. 1).

The Service notified Miami-Dade County in a December 2, 2014, letter about proposed development concerns with potential impacts to listed, candidate, and imperiled species, including the Miami tiger beetle. Plans for the proposed development on the Zoo Miami and USCG parcels have yet to be finalized, so potential impacts to the Miami tiger beetle and its habitat cannot be fully assessed. However, based upon available information provided to date, it appears that the proposed development will impact suitable or potentially suitable beetle habitat.

In July 2014, the Service became aware of another proposed development project on privately owned lands within the Richmond Pine Rocklands. In a July 15, 2014, letter to the proposed developer, the Service named the Miami tiger beetle (along with other federally listed and proposed species and habitats) as occurring within the project footprint, and expressed concern over indirect impacts (e.g., the ability to conduct prescribed fire within the Richmond Pine Rocklands). Based upon applicant plans received in May 2015, the proposed project will contain a variety of commercial, residential, and other development within approximately 138 ac (56 ha) (Ram 2015, p. 4). It is unknown if the Miami tiger beetle occurs on the proposed development site, as only one limited survey has been conducted on a small portion (approximately 1.7 ha (4.3 ac)) of the proposed development area and more surveys are needed. Based upon available information, it appears that the proposed developments will likely impact suitable or potentially suitable beetle habitat, because roughly 33 acres of the proposed development are planned for intact and degraded pine rocklands (Ram 2015, p. 91). The Service has met with the developers to learn more about their plans and address listed, candidate, and imperiled species issues; negotiations are continuing, and a draft habitat conservation plan has been developed (Ram 2015, entire).

Given the species' highly restricted range and uncertain viability, any additional losses are significant. Additional development might further limit the ability to conduct prescribed burns or other beneficial management activities that are necessary to maintain the open areas within pine rockland habitat that are required by the beetle. The pattern of public and private ownership presents an urban wildland interface, which is a known constraint for implementing prescribed fire in similar pine rockland habitats (i.e., at National Key Deer Refuge and in southern Miami-Dade County) (Snyder *et al*. 2005, p. 2; Service 2009, p. 50; 79 FR 47180, August 12, 2014; 79 FR 52567, September 4, 2014). The Florida Department of Forestry has limited staff in Miami-Dade County, and they have been reluctant to set fires for liability reasons (URS 2007, p. 39) (see "Land Management," below).

In summary, given the Miami tiger beetle's highly restricted range and uncertain viability, any additional losses of habitat within its current range present substantial threats to its survival and recovery.

Land Management

The threat of habitat destruction or modification is further exacerbated by a lack of adequate fire management (Brzoska *et al.* 2011, pp. 5–6; Knisley 2013, pp. 7–8; Knisley 2015a, p. 2). Historically, lightning-induced fires were a vital component in maintaining native vegetation within the pine rockland ecosystem, as well as for opening patches in the vegetation required by the beetles (Loope and Dunevitz 1981,

p. 5; Slocum *et al.* 2003, p. 93; Snyder *et al.* 2005, p. 1; Knisley 2011a, pp. 31–32). Open patches in the landscape, which allow for ample sunlight for thermoregulation, are necessary for Miami tiger beetles to perform their normal activities, such as foraging, mating, and oviposition (Knisley 2011a, p. 32). Larvae also require these open patches to complete their development free from vegetation encroachment. Without fire, successional change from tropical pineland to hardwood hammock is rapid, and displacement of native plants by invasive, nonnative plants often occurs, resulting in vegetation overgrowth and litter accumulation in the open, bare, sandy patches that are necessary for the Miami tiger beetle. In the absence of fire, pine rockland will succeed to tropical hardwood hammock in 20 to 30 years, as thick duff layer accumulates and eventually results in the appearance of humic soils rather than mineral soils (Alexander 1967, p. 863; Wade *et al.* 1980, p. 92; Loope and Dunevitz 1981, p. 6; Snyder *et al.* 1990, p. 260).

Miami-Dade County has implemented various conservation measures, such as burning in a mosaic pattern and on a small scale, during prescribed burns, to help conserve the Miami tiger beetles and other imperiled species and their habitats (J. Maguire, 2010, pers. comm.). Miami-Dade County Parks and Recreation staff has burned several of its conservation lands on fire return intervals of approximately 3 to 7 years. However, implementation of the county's prescribed fire program has been hampered by a shortage of resources, logistical difficulties, smoke management, and public concern related to burning next to residential areas (Snyder *et al*. 2005, p. 2; FNAI 2010, p. 5). Many homes and other developments have been built in a mosaic of pine rockland, so the use of prescribed fire in many places has become complicated because of potential danger to structures and smoke generated from the burns. The risk of liability and limited staff in Miami-Dade County have hindered prescribed fire efforts (URS 2007, p. 39). Nonprofit organizations, such as the Institute for Regional Conservation, have faced similar challenges in conducting prescribed burns, due to difficulties with permitting and obtaining the necessary permissions, as well as hazard insurance limitations (Bradley and Gann 2008, p. 17; G. Gann, 2013, pers. comm.). Few private landowners have the means or desire to implement prescribed fire on their property, and doing so in a fragmented urban environment is logistically difficult and costly (Bradley and Gann 2008, p. 3). Lack of management has resulted in rapid habitat decline on most of the small pine rockland fragments, with the disappearance of federally listed and candidate species where they once occurred (Bradley and Gann 2008, p. 3).

Despite efforts to use prescribed fire as a management tool in pine rockland habitat, sites with the Miami tiger beetle are not burned as frequently as needed to maintain suitable beetle habitat. Most of the occupied beetle habitat at Miami-Dade County's Zoo Miami parcel was last burned in January and October of 2007; by 2010, there was noticeable vegetation encroachment into suitable habitat patches (Knisley 2011a, p. 36). The northern portion (Zoo A) of the Zoo Miami site was burned in November 2014 (Knisley 2015c, p. 3). Several occupied locations at the CSTARS parcel were burned in 2010, but four other locations at CSTARS were last burned in 2004 and 2006 (Knisley 2011a, p. 36). No recent burns are believed to have occurred at the USCG parcel (Knisley 2011a, p. 36). The decline in adult numbers at the two primary Zoo Miami patches (A and B) in 2014 surveys, and the few larvae found there in recent years, may be a result of the observed loss of bare open patches (Knisley 2015a, p. 12; Knisley 2015c, pp. 1–3). Surveys of the CSTARS and USCG parcels in 2014 found similar loss of open patches from encroaching vegetation (Knisley 2015a, p. 13).

Alternatives to prescribed fire, such as mechanical removal of woody vegetation are not as ecologically effective as fire. Mechanical treatments do not replicate fire's ability to recycle nutrients to the soil, a process that is critical to many pine rockland species (URS 2007, p. 39). To prevent organic soils from developing, uprooted woody debris requires removal, which adds to the required labor. The use of mechanical equipment can also damage soils and inadvertently include the removal or trampling of other non-target species or critical habitat (URS 2007, p. 39).

Nonnative plants have significantly affected pine rocklands (Bradley and Gann 1999, pp. 15, 72; Bradley and Gann 2005, page numbers not applicable; Bradley and van der Heiden 2013, pp. 12–16). As a result of human activities, at least 277 taxa of nonnative plants have invaded pine rocklands throughout south Florida (Service 1999, p. 3-175). *Neyraudia neyraudiana* (Burma reed) and *Schinus terebinthifolius* (Brazilian pepper), which have the ability to rapidly invade open areas, threaten the habitat needs of the Miami tiger beetle (Bradley and Gann 1999, pp. 13, 72). *S. terebinthifolius*, a nonnative tree, is the most widespread and one of the most invasive species. It forms dense thickets of tangled, woody stems that completely shade out and displace native vegetation (Loflin 1991, p. 19; Langeland and Craddock Burks 1998, p.

54). *Acacia auriculiformis* (earleaf acacia), *Melinis repens* (natal grass), *Lantana camara* (shrub verbena), and *Albizia lebbeck* (tongue tree) are some of the other nonnative species in pine rocklands. More species of nonnative plants could become problems in the future, such as *Lygodium microphyllum* (Old World climbing fern), which is a serious threat throughout south Florida.

Nonnative, invasive plants compete with native plants for space, light, water, and nutrients, and make habitat conditions unsuitable for the Miami tiger beetle, which responds positively to open conditions. Invasive nonnatives also affect the characteristics of a fire when it does occur. Historically, pine rocklands had an open, low understory where natural fires remained patchy with low temperature intensity. Dense infestations of *Neyraudia neyraudiana* and *Schinus terebinthifolius* cause higher fire temperatures and longer burning periods. With the presence of invasive, nonnative species, it is uncertain how fire, even under a managed situation, will affect habitat conditions or Miami tiger beetles.

Management of nonnative, invasive plants in pine rocklands in Miami-Dade County is further complicated because the vast majority of pine rocklands are small, fragmented areas bordered by urban development. Fragmentation results in an increased proportion of "edge" habitat, which in turn has a variety of effects, including changes in microclimate and community structure at various distances from the edge (Margules and Pressey 2000, p. 248); altered spatial distribution of fire (greater fire frequency in areas nearer the edge) (Cochrane 2001, pp. 1518–1519); and increased pressure from nonnative, invasive plants and animals that may out-compete or disturb native plant populations. Additionally, areas near managed pine rockland that contains nonnative species can act as a seed source of nonnatives, allowing them to continue to invade the surrounding pine rockland (Bradley and Gann 1999, p. 13).

Conservation Efforts To Reduce the Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range

In 2005, the Service funded the Institute for Regional Conservation (IRC) to facilitate restoration and management of privately owned pine rockland habitats in Miami-Dade County. This initiative included prescribed burns, nonnative plant control, light debris removal, hardwood management, reintroduction of pines where needed, and development of management plans. The Pine Rockland Initiative includes 10-year cooperative agreements between participating landowners and the Service/IRC to ensure restored areas will be managed appropriately during that time. Although most of these objectives regarding nonnative plant control, creation of fire breaks, removal of excessive fuel loads, and management plans have been achieved, IRC has not been able to conduct the desired prescribed burns, due to logistical difficulties as discussed above (see "Land Management"). IRC has recently resolved some of the challenges regarding contractor availability for prescribed burns and the Service has extended IRC's funding period through August 2016. Results from anticipated fire management restoration activities will be available in the fall of 2016.

Fairchild Tropical Botanic Garden (FTBG), with the support of various Federal, State, local, and nonprofit organizations, has established the "Connect to Protect

Network." The objective of this program is to encourage widespread participation of citizens to create corridors of healthy pine rocklands by planting stepping stone gardens and rights-of-way with native pine rockland species, and restoring isolated pine rockland fragments. Although these projects may serve as valuable components toward the conservation of pine rockland species and habitat, they are dependent on continual funding, as well as participation from private landowners, both of which may vary through time.

Summary of Factor A

We have identified a number of threats to the habitat of the Miami tiger beetle, which have occurred in the past, are impacting the species now, and will continue to impact the species in the future. Habitat loss, fragmentation, and degradation, and associated pressures from increased human population, are major threats; these threats are expected to continue, placing the species at greater risk. The species' occurrence on pine rocklands that are partially protected from development (see "Local" under Factor D, below) tempers some impacts, yet the threat of further loss and fragmentation of habitat remains. Various conservation programs are in place, and while these help to reduce some threats of habitat loss and modification, these programs are limited in nature. In general, available resources and land management activities (*e.g.*, prescribed fire and invasive plant control) on public and private lands are inadequate to prevent modification and degradation of the species' habitat. Therefore, based on our analysis of the best available information, the present and future loss and modification of the species' habitat are major threats to the Miami tiger beetle throughout its range.

Factor B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Collection

Rare beetles, butterflies, and moths are highly prized by collectors. Tiger beetles are the subject of more intense collecting and study than any other single beetle group (Pearson 1988, pp. 123–124; Knisley and Hill 1992a, p. 9; Choate 1996, p. 1; Knisley *et al*. 2014, p. 94). Interest in the genus *Cicindela* (and *Cicindelidia*) is reflected in a journal entitled "Cicindela," which has been published quarterly since 1969 and is exclusively devoted to the genus. Tiger beetle collecting and the sale and trade of specimens have increased in popularity in recent years (Knisley *et al.* 2014, p. 138). Among the professional researchers and many amateurs that collect tiger beetles are individuals that take only small numbers; however, there are also avid collectors who take as many specimens as possible, often for sale or trade. At present, it is estimated that nationally 50 to 100 individuals collect tiger beetles, and approximately 50 individuals are avid collectors (Knisley 2015b, p. 14). Knowledge of and communication with many of these collectors suggest sale and trading of specimens has become much more common in recent years. The increased interest in collecting, along with photographing specimens, seems to have been stimulated in part due to the publication of the tiger beetle field guide (Pearson *et al.* 2006, entire). Collectors are especially interested in the less common forms, and may have little regard for their conservation (Knisley 2015b, p. 14). There is ample evidence of collectors impacting imperiled and endangered butterflies (Gochfeld and Burger 1997, pp. 208– 209) and even contributing to extirpations (Duffey 1968, p. 94). For example, the federally endangered Mitchell's satyr (*Neonympha mitchellii mitchellii*) is believed to have been extirpated from New Jersey due to overcollecting (57 FR 21567, May 20, 1992; Gochfeld and Burger 1997, p. 209).

Collection is serious threat to the Miami tiger beetle due to extreme rarity (a factor that increases demand by collectors) and vulnerability (*i.e*., uncertain status and viability with just two known populations and few individuals). Collection is especially problematic if adults are taken prior to oviposition or from small, isolated, or poor-quality sites. Because no large, high-quality sites are currently known, any collection can have serious ramifications on the survival of the remaining population(s).

The recent description of the species did not disclose the exact locations of occurrence, due to concerns with collection (Brzoska *et al*. 2011, p. 5); however, it is now believed that occurrences at Zoo Miami, USCG, and CSTARS in the Richmond population are fairly well known, especially in the tiger beetle collecting community (B. Knisley, 2014b, pers. comm.). We have no specific information on the collection pressure for the Miami tiger beetle, but it is expected to be high based upon what has transpired in comparable situations with other federally listed and imperiled tiger beetles and butterflies both nationwide and in Florida. For example, the federally endangered

Ohlone tiger beetle (*Cicindela ohlone*) was collected from its type locality in California after its description in the scientific literature (66 FR 50340, October 3, 2001) (Knisley 2015a, p. 14). Similarly, overcollection of the Highlands tiger beetle may have contributed to the extirpation of that species from its type locality in Florida (Knisley and Hill 1992a, p. 9). An estimated 500 to 1,000 adult Highlands tiger beetles had been collected at this site during a several year period after its initial discovery (Knisley and Hill 1992a, p. 10).

Markets currently exist for tiger beetles. Specimens of two Florida tiger beetles, the Highlands tiger beetle, a federal candidate species, and the scrub tiger beetle are regularly offered for sale or trade through online insect dealers (The Bugmaniac 2015 and eBay 2015). Considering the recent rediscovery of the Miami tiger beetle and concerns regarding its continued existence, the desirability of this species to private collectors is expected to increase, which may lead to similar markets and increased demand.

Another reason it is not possible to assess actual impacts from collection is that known occurrences of the Miami tiger beetle are not regularly monitored. Two known occurrences on the USCG and CSTARS parcels are gated and accessible only by permit, so collection from these sites is unlikely unless authorized by the property owners. However, other occupied and potential habitats at neighboring and surrounding areas are much more accessible. Risk of collection is concerning at any location and is more likely at less secure sites. Collection potential at Zoo Miami and other accessible sites is high, in part because it is not entirely gated and only periodically patrolled (B. Knisley, 2014b, pers. comm.). Most of the remaining pine rockland habitat outside of ENP in Miami

Dade County is owned by the County or in private ownership and not regularly monitored or patrolled.

We consider collection to be a significant threat to the Miami tiger beetle in light of the few known remaining populations, low abundance, and highly restricted range. Even limited collection from the remaining populations could have deleterious effects on reproductive and genetic viability of the species and could contribute to its extinction. Removal of adults early in the flight season or prior to oviposition can be particularly damaging, as it further reduces potential for successful reproduction. A population may be reduced to below sustainable numbers (Allee effect) by removal of females, reducing the probability that new occurrences will be founded. Small and isolated occurrences in poor habitat may be at greatest risk (see Factor E discussion, below) as these might not be able to withstand additional losses. Collectors may be unable to recognize when they are depleting occurrences below the thresholds of survival or recovery (Collins and Morris 1985, pp. 162–165).

With regard to scientific research, we do not believe that general techniques used to date have had negative impacts on the species or its habitat. Visual index surveys and netting for identification purposes have been performed during scientific research and conservation efforts with the potential to disturb or injure individuals or damage habitat. Limited collection as part of laboratory rearing studies or taxonomic verification has occurred at some sites, with work authorized by permits. Based on the extreme rarity of the species, various collecting techniques (*e.g.*, pitfall traps, Malaise traps, light traps) for other more general insect research projects should be considered a potential threat.

Summary of Factor B

Collection interest in tiger beetles, especially rare species, is high, and markets currently exist. While it is not possible to quantify the impacts of collection on the Miami tiger beetle, collection of the Highlands tiger beetle has been documented in large numbers, and collection is currently occurring. The risk of collection of the Miami tiger beetle from both occupied and other potential habitat is high, as some sites are generally accessible and not monitored or patrolled. Due to the few remaining populations, low abundance, and restricted range, we have determined that collection is a significant threat to the species and could potentially occur at any time. Even limited collection from the remaining populations could have negative effects on reproductive and genetic viability of the species and could contribute to its extinction.

Factor C. Disease or Predation

There is no evidence of disease or pathogens affecting the Miami tiger beetle, although this threat has not been investigated. Parasites and predators, however, have been found to have significant impacts on adult and larval tiger beetles. In general, parasites are considered to have greater effects on tiger beetles than predators (Nagano 1982, p. 34; Pearson 1988, pp. 136–138). While parasites and predators play important roles in the natural dynamics of tiger beetle populations, the current small size of the Miami tiger beetle populations may render the species more vulnerable to parasitism and predation than historically, when the species was more widely distributed and therefore more resilient.

Known predators of adult tiger beetles include birds, lizards, spiders, and especially robber flies (family Asilidae) (Pearson *et al*. 2006, p. 183). Researchers and collectors have often observed robber flies in the field capturing tiger beetles out of the air. Pearson (1985, pp. 68–69; 1988, p. 134) found tiger beetles with orange abdomens (warning coloration) were preyed upon less frequently than similar-sized tiger beetles without the orange abdomens. His field trials also determined that size alone provided some protection from robber flies, which are usually only successful in killing prey that is smaller than they are. This was the case with the hairy-necked tiger beetle (*Cicindela hirticollis*) being attacked at a significantly higher rate than the larger northeastern beach tiger beetle in Maryland (Knisley and Hill 2010, pp. 54–55). On the basis of these field studies, it was estimated that robber flies may cause over 50 percent mortality to the hairy-necked tiger beetle and 6 percent to the northeastern beach tiger beetle population throughout the flight season (Knisley and Hill 2010, pp. 54–55). The small body size of the Miami tiger beetle, even with its orange abdomen, suggests it would be susceptible to robber fly attack. No robber flies have been observed during the limited field studies on the Miami tiger beetle; however, they are a common predator of the closely related Highlands tiger beetle (Knisley and Hill 2013, p. 40). In 24 hours of field study, Knisley and Hill (2013, p. 40) observed 22 attacks by robber flies on Highlands tiger beetles, 5 of which resulted in the robber fly killing and consuming the adult beetles.

Most predators of adult tiger beetles are opportunistic, feeding on a variety of available prey, and therefore probably have only a limited impact on tiger beetle populations. However, predators, and especially parasites, of larvae are more common and some attack only tiger beetles. Ants are regarded as important predators on tiger beetles, and although not well studied, they have been reported having significant impact on first instar larvae of some Arizona tiger beetles (*Cicindela spp*.) (Knisley and Juliano 1988, p. 1990). A study with the Highlands tiger beetle found ants accounted for 11 to 17 percent of larval mortality at several sites, primarily involving first instars (Knisley and Hill 2013, p. 37). During surveys for the Miami tiger beetle, various species of ants were commonly seen co-occurring in the sandy patches with adults and larvae, but their impact, if any, is unknown at this time.

Available literature indicates that the most important tiger beetle natural enemies are tiphiid wasps and bombyliid flies, which parasitize larvae (Knisley and Schultz 1997, pp. 53–57). The wasps enter the larvae burrows, and paralyze and lay an egg on the larvae. The resulting parasite larva consumes the host tiger beetle larva. Bombyliid flies (genus *Anthrax*) drop eggs into larval burrows with the resulting fly larvae consuming the tiger beetle larva. These parasitoids accounted for 20 to 80 percent mortality in larvae of several northeastern tiger beetles (Pearson and Vogler 2001, p. 172). Parasitism from bombyliid flies accounted for 13 to 25 percent mortality to larvae of the Highlands tiger beetle at several sites (Knisley and Hill 2013, p. 37). Generally, these rates of parasitism are similar to those reported for other species of tiger beetles (Bram and Knisley 1982, p. 99; Palmer 1982, p. 64; Knisley 1987, p. 1198). No tiphiid wasps or bombyliid flies were observed during field studies with the Miami tiger beetle (Knisley 2015a, p. 15); however, tiphiid wasps are small, secretive, and evidence of their attacks is difficult to find (Knisley 2015b, p. 16).

Summary of Factor C

Potential impacts from predators or parasites to the Miami tiger beetle are unknown. Given the small size of the Miami tiger beetle's two populations, the species is likely vulnerable to predation and parasitism.

Factor D. The Inadequacy of Existing Regulatory Mechanisms

Section 4(b)(1)(A) of the Act requires the Service to take into account "those efforts, if any, being made by any State or foreign nation, or any political subdivision of a State or foreign nation, to protect such species…." In relation to Factor D, we interpret this language to require the Service to consider relevant Federal, State, and Tribal laws, plans, regulations, and other such mechanisms that may minimize any of the threats we describe in threat analyses under the other four factors, or otherwise enhance conservation of the species. We give strongest weight to statutes and their implementing regulations and to management direction that stems from those laws and regulations. An example would be State governmental actions enforced under a State statute or constitution, or Federal action under statute.

Federal

The Miami tiger beetle currently has no Federal protective status and has limited regulatory protection in its known occupied and suitable habitat. The species is not known to occur on National Wildlife Refuge or National Park land. The Miami tiger beetle is known to occur on USCG lands within the Richmond Pinelands Complex, and there are limited protection for the species on this property; any USCG actions or decisions that may have an effect on the environment would require consideration and review under the National Environmental Policy Act (NEPA) (42 U.S.C. 4321 *et seq.*). No Federal permit or other authorization is currently needed for potential impacts to known occurrences on county-owned and private land. The Miami tiger beetle could be afforded limited protections from sections 7 and 10 of the Act based on its co-occurrence with listed species or their critical habitat, if applicable, within the Richmond Pine Rocklands, including species such as the Bartram's scrub-hairstreak butterfly (*Strymon acis bartrami*), Florida leafwing butterfly (*Anaea troglodyta floridalis*), Florida bonneted bat (*Eumops floridanus*), Florida brickell-bush (*Brickellia mosieri*), Carter's small-flowered flax (*Linum carteri* var. *carteri*), deltoid spurge (*Chamaesyce deltoidea* ssp. *deltoidea*), and tiny polygala (*Polygala smallii*). However, effect determinations and minimization and avoidance criteria for any of these listed species are unlikely to be fully protective to the Miami tiger beetle considering its extreme rarity. The listed species have broader distributions that allow for more flexibility with appropriate conservation measures. In contrast, with only two known populations and few remaining adults, the Miami tiger beetle has a much lower threat tolerance. Although the beetle is not currently federally protected, the Service has met with Miami-Dade County, the USCG, the University of Miami, and potential developers to express our concern regarding listed, proposed, candidate, and imperiled species in the Richmond Pine Rocklands, including the Miami tiger beetle. We have recommended that management and habitat conservation plans include and fully consider this species and its habitat.

State

The Miami tiger beetle is not currently listed as endangered or threatened by the State of Florida, so there are no existing regulations designated to protect it. The Miami tiger beetle is recognized as a species of greatest conservation need by the FWC (FWC 2012, p. 89). Species of greatest conservation need designation is part of the State's strategy to recognize and seek funding opportunities for research and conservation of these species, particularly through the State Wildlife Grants program. The list is extensive and, to date, we are unaware of any dedicated funding from this program for the beetle. The Miami tiger beetle is not known to occur on lands owned by the State of Florida; however, not all State-owned pine rockland parcels have been adequately surveyed. It is possible that some State-owned parcels do provide potentially suitable habitat, and support occurrences of, the Miami tiger beetle.

Local

In 1984, section 24–49 of the Code of Miami-Dade County established regulation of County-designated Natural Forested Communities (NFCs), which include both pine rocklands and tropical hardwood hammocks. These regulations were placed on specific properties throughout the county by an act of the Board of County Commissioners in an effort to protect environmentally sensitive forest lands. The Miami-Dade County Department of Regulatory and Economic Resources (RER) has regulatory authority over NFCs, and is charged with enforcing regulations that provide partial protection on the Miami Rock Ridge. Miami-Dade Code typically allows up to 20 percent of a pine rockland designated as NFC to be developed, and requires that the remaining 80 percent be placed under a perpetual covenant. In certain circumstances, where the landowner can demonstrate that limiting development to 20 percent does not allow for "reasonable use" of the property, additional development may be approved. NFC landowners are also required to obtain an NFC permit for any work within the boundaries of the NFC on their property. The NFC program is responsible for ensuring that NFC permits are issued in accordance with the limitations and requirements of the code and that appropriate NFC preserves are established and maintained in conjunction with the issuance of an NFC permit. The NFC program currently regulates approximately 600 pine rockland or pine rockland/hammock properties, comprising approximately 1,200 ha (3,000 ac) of habitat (J. Joyner, 2013, pers. comm.). When RER discovers unpermitted activities, it takes appropriate enforcement action, and seeks restoration when possible. Because these regulations allows for development of pine rockland habitat, and because unpermitted development and destruction of pine rockland continues to occur, the regulations are not fully effective at protecting against loss of Miami tiger beetles or their potential habitat.

Under Miami-Dade County ordinance (section 26-1), a permit is required to conduct scientific research (rule 9) on county environmental lands. In addition, rule 8 of this ordinance provides for the preservation of habitat within County parks or areas operated by the Parks and Recreation Department. The scientific research permitting effectively allows the County to monitor and manage the level of scientific research and collection of the Miami tiger beetle, and the preservation of pine rockland habitat benefits the beetle.

Fee Title Properties: In 1990, Miami-Dade County voters approved a 2-year property tax to fund the acquisition, protection, and maintenance of environmentally endangered lands (EEL). The EEL Program identifies and secures these lands for preservation. Under this program to date, Miami-Dade County has acquired a total of approximately 255 ha (630 ac) of pine rocklands. In addition, approximately 445 ha (1,100 ac) of pine rocklands are owned by the Miami-Dade County Parks and Recreation Department and managed by the EEL Program, including some of the largest remaining areas of pine rockland habitat on the Miami Rock Ridge outside of ENP (*e.g.*, Larry and Penny Thompson Park, Zoo Miami pinelands, and Navy Wells Pineland Preserve).

Summary of Factor D

There are some regulatory mechanisms currently in place to protect the Miami tiger beetle and its habitat on non-Federal lands. However, there are no Federal regulatory protections for the Miami tiger beetle, other than the limited protections afforded for listed species and critical habitat that co-occur with the Miami tiger beetle. While local regulations provide some protection, they are generally not fully effective (*e.g.*, NFC regulations allow development of 20 percent or more of pine rockland habitat) or implemented sufficiently (*e.g.*, unpermitted clearing of pine rockland habitat) to alleviate threats to the Miami tiger beetle and its habitat. The degradation of habitat for the Miami tiger beetle is ongoing despite existing regulatory mechanisms. Based on our analysis of the best available information, we find that existing regulatory measures, due to a variety of constraints, are inadequate to fully address threats to the species throughout its range.

Factor E. Other Natural or Manmade Factors Affecting Its Continued Existence

Few, Small, Isolated Populations

The Miami tiger beetle is vulnerable to extinction due to its severely reduced range, the fact that only two small populations remain, and the species' relative isolation.

Demographic stochasticity refers to random variability in survival or reproduction among individuals within a population (Shaffer 1981, p. 131). Demographic stochasticity can have a significant impact on population viability for populations that are small, have low fecundity, and are short-lived. In small populations, reduced reproduction or die-offs of a certain age-class will have a significant effect on the whole population. Although of only minor consequence to large populations, this randomly occurring variation in individuals becomes an important issue for small populations.

Environmental stochasticity is the variation in birth and death rates from one season to the next in response to weather, disease, competition, predation, or other factors external to the population (Shaffer 1981, p. 131). For example, drought or predation, in combination with a low population year, could result in extirpation. The origin of the environmental stochastic event can be natural or human-caused.

In general, tiger beetles that have been regularly monitored consistently exhibit extreme fluctuations in population size, often apparently due to climatic or other habitat factors that affect recruitment, population growth, and other population parameters. In 20 or more years of monitoring, most populations of the northeastern beach and puritan tiger beetles (*Cicindela puritan*) have exhibited 2 to 5 or more fold differences in abundance (Knisley 2012, entire). Annual population estimates of the Coral Pink Sand Dunes tiger beetle (*Cicindela albissima*) (have ranged from fewer than 600 to nearly 3,000 adults over a 22-year period (Gowan and Knisley 2014, p. 124). The Miami tiger beetle has not been monitored as extensively as these species, but in areas where Miami tiger beetles were repeatedly surveyed, researchers found fluctuations that were several fold in numbers (Knisley 2015a, p. 24). While these fluctuations appear to be the norm for populations of tiger beetles (and most insects), the causes and effects are not well known. Among the suggested causes of these population trends are annual rainfall patterns for the Coral Pink Sand Dunes tiger beetle (Knisley and Hill 2001, p. 391; Gowan and Knisley 2014, p. 119), and shoreline erosion from storms for the northeastern beach and puritan tiger beetles (Knisley 2011b, p. 54). As a result of these fluctuations, many tiger beetle populations will experience episodic low numbers (bottlenecks) or even local extinction from genetic decline, the Allee effect, or other factors. Given that the Miami tiger beetle is only known from two remaining populations with few adult individuals, any significant decrease in the population size could easily result in extinction of the species.

Dispersal and movement of the Miami tiger beetle is unknown, but is considered to be very limited. A limited mark-recapture study with the closely related Highlands tiger beetle found that adult beetles moved no more than 150 m (490 ft), usually flying only 5–10 m (16–33 ft) at a time (Knisley and Hill 2013). Generally, tiger beetles are known to easily move around, so exchange of individuals among separated sites will commonly occur if there are habitat connections or if the sites are within dispersal range—which is not the case with the population structure of the Miami tiger beetle. Species in woodland, scrub, or dune habitats also seem to disperse less than water-edge species (Knisley and Hill 1996, p. 13). Among tiger beetles, there is a general trend of decreasing flight distance with decreasing body size (Knisley and Hill 1996, p. 13). The Miami tiger beetle has a small body size. Given these factors, dispersal may be limited for the Miami tiger beetle.

Small, isolated population size was listed as one of several of the threats in the petition received to list the Miami tiger beetle (CBD *et. al*. 2014, pp. 17, 30). The effects of low population size on population viability are not known for tiger beetles, but population viability analyses for the northeastern beach, puritan, and Coral Pink Sand Dunes tiger beetles determined that stochasticity, specifically the fluctuations in population size, was the main factor accounting for the high risk of extinction (Gowan and Knisley 2001, entire; 2005, p. 13; Knisley and Gowan 2009, pp. 13–23). The long-term monitoring of northeastern beach and puritan tiger beetles found that, despite the fluctuations, some small populations with fewer than 50 to 100 adults experienced several fold declines, but persisted (Knisley 2015b, p. 20). Several Highlands tiger beetle sites with fewer than 20 to 50 adults were lost over the past 15–20 years, while several others have persisted during that period (Knisley 2015b, p. 20). Losses may have been due to habitat disturbance or low population size effects. Knisley predicts that the Highlands tiger beetle populations (extinct and extant) are isolated from each other with little chance for dispersal between populations and immigration rescues (B. Knisley, 2015d, pers. comm.). With only two known populations of the Miami tiger beetle, separated by substantial urban development, the potential for immigration rescue is low.

Pesticides

Pesticides used in and around pine rockland habitat are a potential threat to the Miami tiger beetle through direct exposure to adults and larvae, secondary exposure from insect prey, overall reduction in availability of adult and larval prey, or any combination of these factors. The use of pesticides for agriculture and mosquito control presents potential risks to nontarget insects, especially imperiled insects (EPA 2002, p. 32; 2006a, p. 58; 2006b, p. 44). The negative effect of insecticides on several tiger beetle species was suggested by Nagano (1980, p. 34) and Stamatov (1972, p. 78), although impacts from pesticides do not appear to be well studied in tiger beetles.

Efforts to control mosquitoes and other insect pests in Florida have increased as human activity and population size have increased. To control mosquito populations, organophosphate (naled) and pyrethroid (permethrin) adulticides are applied by mosquito control districts throughout south Florida, including Miami-Dade County. These compounds have been characterized as being highly toxic to nontarget insects by the U.S. Environmental Protection Agency (2002, p. 32; 2006a, p. 58; 2006b, p. 44). The use of such pesticides (applied using both aerial and ground-based methods) for mosquito control presents a potential risk to the Miami tiger beetle.

In order for mosquito control pesticides to be effective, they must make direct contact with mosquitoes. For this to happen, pesticides are applied using methods to promote drift through the air, so as to increase the potential for contact with their intended target organism. Truck-based permethrin application methods are expected to produce a swath of suspended pesticides approximately 91 m (300 ft) wide (Prentiss 2007, p. 4). The extent of pesticide drift from this swath is dependent on several factors, including wind speed, wind direction, and vegetation density. Hennessey and Habeck (1989, pp. 1–22; 1991, pp. 1–68) and Hennessey *et al.* (1992, pp. 715–721) illustrated the presence of mosquito spray residues long after application in habitat of the federally endangered Schaus swallowtail butterfly (*Papilio aristodemus ponceanus*), as well as the Florida leafwing butterfly (*Anaea troglodyta floridalis*), Bartram's scrub-hairstreak butterfly, and other imperiled species. Residues of aerially applied naled were found 6 hours after application in a pineland area that was 750 m (2,460 ft) from the target area; residues of fenthion (an adulticide previously used in the Florida Keys) applied via truck were found up to 50 m (160 ft) downwind in a hammock area 15 minutes after application in adjacent target areas (Hennessey *et al.* 1992, pp. 715–721).

More recently, Pierce (2009, pp. 1–17) monitored naled and permethrin deposition following mosquito control application. Permethrin, applied by truck, was found to drift considerable distances from target areas, with residues that persisted for weeks. Permethrin was detected at concentrations lethal to three butterfly species at a distance of approximately 227 m (745 ft) away from targeted truck routes. Naled, applied by plane, was also found to drift into nontarget areas, but was much less persistent, exhibiting a half-life (time for half of the naled applied to chemically break down) of approximately 6 hours. To expand this work, Pierce (2011, pp. 6–11) conducted an additional deposition study in 2010, focusing on permethrin drift from truck spraying, and again documented low but measurable amounts of permethrin in nontarget areas. In 2009, Bargar (2012, p. 3) conducted two field trials that detected significant naled residues at locations within nontarget areas up to 366 m (1,200 ft) from the edge of zones targeted for aerial applications. After this discovery, the Florida Keys Mosquito Control District recalibrated the on-board model (Wingman, which provides flight guidance and flow rates). Naled deposition was reduced in some of the nontarget zones following recalibration (Bargar 2012, p. 3).

In addition to mosquito control chemicals entering nontarget areas, the toxic effects of such chemicals to nontarget organisms have also been documented. Lethal effects on nontarget moths and butterflies have been attributed to fenthion and naled in both south Florida and the Florida Keys (Emmel 1991, pp. 12–13; Eliazar and Emmel 1991, pp. 18–19; Eliazar 1992, pp. 29–30). Zhong *et al.* (2010, pp. 1961–1972) investigated the impact of single aerial applications of naled on the endangered Miami blue butterfly (*Cyclargus thomasi bethunebakeri*) larvae in the field. Survival of butterfly larvae in the target zone was 73.9 percent, which was significantly lower than in both the drift zone (90.6 percent) and the reference (control) zone (100 percent), indicating that direct exposure to naled poses significant risk to Miami blue butterfly larvae. Fifty percent of the samples in the drift zone also exhibited detectable concentrations, once again exhibiting the potential for mosquito control chemicals to drift into nontarget areas. Bargar (2012, p. 4) observed cholinesterase activity depression, to a level shown to cause mortality in the laboratory, in great southern white (*Ascia monuste*) and Gulf fritillary butterflies (*Agraulis vanillae*) exposed to naled in both target and nontarget zones.

Based on these studies, it can be concluded that mosquito control activities that involve the use of both aerial and ground-based spraying methods have the potential to deliver pesticides in quantities sufficient to cause adverse effects to nontarget species in both target and nontarget areas. Pesticide drift at a level of concern to nontarget invertebrates (butterflies) has been measured up to approximately 227 m (745 ft) from truck routes (Pierce 2011, pp. 3-5, 7; Rand and Hoang 2010, pp. 14, 23) and 400 m (1,312 ft) from aerial spray zones (Bargar 2012, p. 3). It should be noted that many of the studies referenced above dealt with single application scenarios and examined effects on only one or two butterfly life stages. Under a realistic scenario, the potential exists for exposure to all life stages to occur over multiple applications in a season. In the case of a persistent compound like permethrin, whose residues remain on vegetation for weeks, the potential exists for nontarget species to be exposed to multiple pesticides within a season (*e.g.*, permethrin on vegetation coupled with aerial exposure to naled).

Prior to 2015, aerial applications of mosquito control pesticides occurred on a limited basis (approximately two to four aerial applications per year since 2010) within some of Miami-Dade County's pine rockland areas. The Miami tiger beetle is not known to occupy any of these aerial spray zone sites, but any unknown occupied sites could have been exposed, either directly or through drift. The Richmond Pine Rocklands region is not directly treated either aerially or by truck (C. Vasquez, 2013, pers. comm.), so any potential pesticide exposure in this area would be through drift from spray zones adjacent to the Richmond area. Pesticide drift from aerial spray zones to the two known populations of Miami tiger beetles is unlikely, based on the considerable distance from spray zone boundaries to known occurrences of the beetle (estimated minimum distances range from 2.0–3.0 km (1.2–1.9 mi) from the Richmond population and 434 m (0.3 mi) for the second population). In the past, truck-based applications occurred within 227 m (745 ft) of known occupied Miami tiger beetle habitat, a distance under which pesticide drift at a concentration of concern for nontarget invertebrates had been measured (Pierce 2011, pp. 3-5, 7; Rand and Hoang 2010, pp. 14, 23). For the 2015 mosquito season (May through October), Miami-Dade Mosquito Control coordinated with the Service to institute 250-m truck-based and 400-m aerial spray buffers around critical habitat for the Bartram's scrub-hairstreak butterfly, with the exclusion of pine rocklands in the Navy Wells area, which is not known to be occupied by the Miami tiger beetle. These newly implemented buffers will also reduce exposure to any other imperiled species occurring on pine rockland habitat within Bartram's scrub-hairstreak butterfly critical habitat, such as the Miami tiger beetle. Assuming that the Miami tiger beetle is no more sensitive to pesticide exposure than the tested butterfly species, these spray buffers should avoid adverse impacts to the Miami tiger beetle population.

Based on Miami-Dade Mosquito Control's implementation of spray buffers, mosquito control pesticides are not considered a major threat for the Miami tiger beetle at this time. If these buffers were to change or Miami tiger beetles were found to occur on habitat that is not protected by Bartram's scrub-hairstreak butterfly critical habitat, then the threat of pesticide exposure would have to be reevaluated.

Human Disturbance

Human disturbance, depending upon type and frequency, may or may not be a threat to tiger beetles or their habitats. Knisley (2011b, entire) reviewed both the negative and positive effects of human disturbances on tiger beetles. Vehicles, bicycles, and human foot traffic have been implicated in the decline and extirpation of tiger beetle populations, especially for species in more open habitats like beaches and sand dunes. The northeastern beach tiger beetle was extirpated throughout the northeast coincidental with the development of recreational use from pedestrian foot traffic and vehicles (Knisley et al 1987, p. 301). *Habroscelimorpha dorsalis media* (southeastern beach tiger beetle) was extirpated from a large section of Assateague Island National Seashore, Maryland, after the initiation of off- highway vehicle (OHV) use (Knisley and Hill, 1992b, p. 134). Direct mortality and indirect effects on habitat from OHVs have been found to threaten the survival of Coral Pink Sand Dunes tiger beetle (Gowan and Knisley 2014, pp. 127–128). However, there are other documented cases of the beneficial effects of these types of disturbances, by creating open areas of habitat for tiger beetles, particularly at sites where vegetation growth has eliminated these open habitat patches (Knisley 2011, pp. 44–45). The Ohlone tiger beetle has been eliminated from nearly all natural grassland areas in Santa Cruz, California, except where pedestrian foot traffic, mountain bike use, or cattle grazing has created or maintained trails and open patches of habitat (Knisley and Arnold 2013, p. 578). Similarly, over 20 species of tiger beetles, including *Cicindela decemnotata* (Badlands tiger beetle) at Dugway Proving Ground in Utah, are almost exclusively restricted to roads, trails, and similar areas kept open by vehicle use or similar human disturbances (Knisley 2011b, pp. 44–45).

Vehicle activity on seldom-used roads may have some negative effect on the Miami tiger beetle (*i.e.*, lethal impacts to adults or larvae or impacts to the habitat), but limited field observations to date indicate that effects are minimal (Knisley 2015a, p. 16). Observations in 2014 at Zoo Miami found a few adults along a little-used road and the main gravel road adjacent to interior patches where adults were more common (Knisley 2015, p. 16). These adults may have dispersed from their primary interior habitat, possibly due to vegetation encroachment (Knisley 2015a, p. 16). Several of the adults at both CSTARS and the USCG parcels were also found along dirt roads that were not heavily used and apparently provided suitable habitat.

The parcels that comprise the two known populations of the Miami tiger beetle are not open to the public for recreational use, so human disturbance is unlikely. For any unknown occurrences of the species, human disturbance from recreational use is a possibility, as some of the remaining pine rockland sites in Miami-Dade County are open to the public for recreational use. Miami-Dade County leads the State in gross urban density at 15.45 people per acre (Zwick and Carr 2006, pp. 1, 13), and development and human population growth are expected to continue in the future. By 2025, Miami-Dade County is predicted to exceed a population size of over 3 million people (Zwick and Carr 2006, p. 20). With the expected future increase in human population and development, there will likely be an increase in the use of recreational areas, including sites with potentially suitable habitat and unknown occurrences of Miami tiger beetles. Projected future increases in recreational use, may increase levels of human disturbance and negatively impact any unknown occurrences of the Miami tiger beetle and their habitat.

In summary, vehicular activity and recreational use within the known population of the Miami tiger beetle presents minimal impacts to the species. However, future negative impacts to unknown beetle occurrences on lands open to the public are possible and are expected to increase with the projected future population growth.

Climate Change and Sea Level Rise

Climatic changes, including sea level rise (SLR), are major threats to Florida, and could impact the Miami tiger beetle and the few remaining parcels of pine rockland habitat left in Miami-Dade County. Our analyses include consideration of ongoing and projected changes in climate. The terms “climate” and “climate change” are defined by the Intergovernmental Panel on Climate Change (IPCC). “Climate” refers to the mean and variability of different types of weather conditions over time, with 30 years being a typical period for such measurements, although shorter or longer periods also may be used (IPCC 2007a, p. 78). The term “climate change” thus refers to a change in the mean or variability of one or more measures of climate (*e.g.*, temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC 2007a, p. 78).

Scientific measurements spanning several decades demonstrate that changes in climate are occurring, and that the rate of change has been faster since the 1950s. Based on extensive analyses of global average surface air temperature, the most widely used measure of change, the IPCC concluded that warming of the global climate system over the past several decades is “unequivocal” (IPCC 2007a, p. 2). In other words, the IPCC concluded that there is no question that the world’s climate system is warming. Examples of other changes include substantial increases in precipitation in some regions of the world and decreases in other regions (for these and additional examples, see IPCC 2007a, p. 30; Solomon *et al*. 2007, pp. 35–54, 82–85). Various environmental changes (*e.g.*, shifts in the ranges of plant and animal species, increasing ground instability in permafrost regions, conditions more favorable to the spread of invasive species and of some diseases, changes in amount and timing of water availability) are occurring in association with changes in climate (see IPCC 2007a, pp. 2–4, 30–33; Global Climate Change Impacts in the United States 2009, pp. 27, 79–88).

Results of scientific analyses presented by the IPCC show that most of the observed increase in global average temperature since the mid-20th century cannot be explained by natural variability in climate, and is “very likely” (defined by the IPCC as 90 percent or higher probability) due to the observed increase in greenhouse gas (GHG) concentrations in the atmosphere as a result of human activities, particularly carbon dioxide emissions from fossil fuel use (IPCC 2007a, pp. 5–6 and figures SPM.3 and SPM.4; Solomon *et al*. 2007, pp. 21–35). Further confirmation of the role of GHGs comes from analyses by Huber and Knutti (2011, p. 4), who concluded it is extremely likely that approximately 75 percent of global warming since 1950 has been caused by human activities.

Scientists use a variety of climate models, which include consideration of natural processes and variability, as well as various scenarios of potential levels and timing of GHG emissions, to evaluate the causes of changes already observed and to project future changes in temperature and other climate conditions (*e.g.*, Meehl *et al*. 2007, entire; Ganguly *et al*. 2009, pp. 11555, 15558; Prinn *et al*. 2011, pp. 527, 529). All combinations of models and emissions scenarios yield very similar projections of average global warming until about 2030. Although projections of the magnitude and rate of warming differ after about 2030, the overall trajectory of all the projections is one of increased global warming through the end of this century, even for projections based on scenarios that assume that GHG emissions will stabilize or decline. Thus, there is strong scientific support for projections that warming will continue through the 21st century, and that the magnitude and rate of change will be influenced substantially by the extent of GHG emissions (IPCC 2007a, pp. 44–45; Meehl *et al*. 2007, pp. 760–764; Ganguly *et al*. 2009, pp. 15555–15558; Prinn *et al*. 2011, pp. 527, 529).

In addition to basing their projections on scientific analyses, the IPCC reports projections using a framework for treatment of uncertainties (e.g., they define "very likely" to mean greater than 90 percent probability, and "likely" to mean greater than 66 percent probability; see Solomon et al. 2007, pp. 22–23). Some of the IPCC's key projections of global climate and its related effects include: (1) It is virtually certain there will be warmer and more frequent hot days and nights over most of the earth's land areas; (2) it is very likely there will be increased frequency of warm spells and heat waves over most land areas; (3) it is very likely that the frequency of heavy precipitation events, or the proportion of total rainfall from heavy falls, will increase over most areas; and (4) it is likely the area affected by droughts will increase, that intense tropical cyclone activity will increase, and that there will be increased incidence of extreme high sea level (IPCC 2007b, p. 8, table SPM.2). More recently, the IPCC published additional information that provides further insight into observed changes since 1950, as well as projections of extreme climate events at global and broad regional scales for the middle and end of this century (IPCC 2011, entire).

Various changes in climate may have direct or indirect effects on species. These may be positive, neutral, or negative, and they may change over time, depending on the species and other relevant considerations, such as interactions of climate with other variables such as habitat fragmentation (for examples, see Franco *et al*. 2006; IPCC 2007a, pp. 8–14, 18–19; Forister *et al*. 2010; Galbraith *et al*. 2010; Chen *et al*. 2011). In addition to considering individual species, scientists are evaluating possible climate change-related impacts to, and responses of, ecological systems, habitat conditions, and groups of species; these studies include acknowledgement of uncertainty (*e.g.*, Deutsch *et* *al*. 2008; Berg *et al*. 2009; Euskirchen *et al*. 2009; McKechnie and Wolf 2009; Sinervo *et al*. 2010; Beaumont *et al*. 2011; McKelvey *et al*. 2011; Rogers and Schindler 2011).

Many analyses involve elements that are common to climate change vulnerability assessments. In relation to climate change, vulnerability refers to the degree to which a species (or system) is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the type, magnitude, and rate of climate change and variation to which a species is exposed, its sensitivity, and its adaptive capacity (IPCC 2007a, p. 89; see also Glick *et al*. 2011, pp. 19–22). There is no single method for conducting such analyses that applies to all situations (Glick *et al*. 2011, p. 3). We use our expert judgment and appropriate analytical approaches to weigh relevant information, including uncertainty, in our consideration of various aspects of climate change.

As is the case with all stressors that we assess, even if we conclude that a species is currently affected or is likely to be affected in a negative way by one or more climate-related impacts, it does not necessarily follow that the species meets the definition of an "endangered species" or a "threatened species" under the Act. If a species is listed as endangered or threatened, knowledge regarding its vulnerability to, and known or anticipated impacts from, climate-associated changes in environmental conditions can be used to help devise appropriate strategies for its recovery.

Global climate projections are informative, and, in some cases, the only or the best scientific information available for us to use. However, projected changes in climate and related impacts can vary substantially across and within different regions of the world (*e.g.*, IPCC 2007a, pp. 8–12). Therefore, 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 (see Glick *et al*. 2011, pp. 58–61, for a discussion of downscaling). For our analysis for the Miami tiger beetle, downscaled projections are available.

According to the Florida Climate Center, Florida is by far the most vulnerable State in the United States to hurricanes and tropical storms (*http://climatecenter.fsu.edu/topics/tropical-weather*). Based on data gathered from 1856 to 2008, Klotzbach and Gray (2009, p. 28) calculated the climatological probabilities for each State being impacted by a hurricane or major hurricane in all years over the 152-year timespan. Of the coastal States analyzed, Florida had the highest climatological probabilities, with a 51 percent probability of a hurricane (Category 1 or 2) and a 21 percent probability of a major hurricane (Category 3 or higher). From 1856 to 2008, Florida actually experienced more major hurricanes than predicted; out of the 109 hurricanes, 36 were major hurricanes. The most recent hurricane to have major impacts to Miami-Dade County was Hurricane Andrew in 1992. While the species persisted after this hurricane, impacts to the population size and distribution from the storm are unknown, because no surveys were conducted until its rediscovery in 2007. Given the few, isolated populations of the Miami tiger beetle within a location prone to storm influences (located approximately 8 km (5 mi) from the coast), the species is at substantial risk from stochastic environmental events such as hurricanes, storm surges, and other extreme weather that can affect recruitment, population growth, and other population parameters.

Other processes to be affected by climate change, related to environmental stochasticity, include temperatures, rainfall (amount, seasonal timing, and distribution), and storms (frequency and intensity). Temperatures are projected to rise from 2–5 degrees Celsius (^{o}C) (3.6–9 degrees Fahrenheit (^{o}F)) for North America by the end of this century (IPCC 2007a, pp. 7–9, 13). Based upon predictive modeling, Atlantic hurricane and tropical storm frequencies are expected to decrease (Knutson *et al.* 2008, pp. 1–21). By 2100, there should be a 10–30 percent decrease in hurricane frequency. Hurricane frequency is expected to drop, due to more wind shear impeding initial hurricane development. However, hurricane winds are expected to increase by 5–10 percent. This is due to more hurricane energy available for intense hurricanes. These stronger winds will result in damage to the pine rockland vegetation and an increased storm surge (discussed below). In addition to climate change, weather variables are extremely influenced by other natural cycles, such as El Niño Southern Oscillation, with a frequency of every 4–7 years; solar cycle (every 11 years); and the Atlantic Multi-decadal Oscillation. All of these cycles influence changes in Floridian weather. The exact magnitude, direction, and distribution of all of these changes at the regional level are difficult to project.

The long-term record at Key West shows that sea level rose on average 0.229 cm (0.090 in) annually between 1913 and 2013 (National Oceanographic and Atmospheric Administration (NOAA) 2013, p. 1). This equates to approximately 22.9 cm (9.02 in) over the last 100 years. IPCC (2008, p. 28) emphasized it is very likely that the average rate of SLR during the 21st century will exceed the historical rate. The IPCC Special Report on Emission Scenarios (2000, entire) presented a range of scenarios based on the computed amount of change in the climate system due to various potential amounts of anthropogenic greenhouse gases and aerosols in 2100. Each scenario describes a future world with varying levels of atmospheric pollution, leading to corresponding levels of global warming and corresponding levels of SLR. The IPCC Synthesis Report (2007a, entire) provided an integrated view of climate change and presented updated projections of future climate change and related impacts under different scenarios.

Subsequent to the 2007 IPCC Report, the scientific community has continued to model SLR. Recent peer-reviewed publications indicate a movement toward increased acceleration of SLR. Observed SLR rates are already trending along the higher end of the 2007 IPCC estimates, and it is now widely held that SLR will exceed the levels projected by the IPCC (Rahmstorf *et al.* 2012, p. 1; Grinsted *et al.* 2010, p. 470). Taken together, these studies support the use of higher end estimates now prevalent in the scientific literature. Recent studies have estimated global mean SLR of 1.0–2.0 m (3.3–6.6 ft) by 2100 as follows: 0.75–1.90 m (2.5–6.2 ft; Vermeer and Rahmstorf 2009, p. 21530), 0.8–2.0 m (2.6–6.6 ft; Pfeffer *et al.* 2008, p. 1342), 0.9–1.3 m (3.0–4.3 ft; Grinsted *et al.* 2010, pp. 469–470), 0.6–1.6 m (2.0–5.2 ft; Jevrejeva *et al.* 2010, p. 4), and 0.5–1.40 m (1.6–4.6 ft; National Research Council 2012, p. 2).

All of the scenarios, from small climate change shifts to major changes, indicate negative effects on pine rockland habitat throughout Miami-Dade County. Prior to inundation, pine rocklands are likely to undergo habitat transitions related to climate change, including changes to hydrology and increasing vulnerability to storm surge. Hydrology has a strong influence on plant distribution in these and other coastal areas (IPCC 2008, p. 57). Such communities typically grade from salt to brackish to freshwater species. From the 1930s to 1950s, increased salinity of coastal waters contributed to the decline of cabbage palm forests in southwest Florida (Williams *et al.* 1999, pp. 2056–2059), expansion of mangroves into adjacent marshes in the Everglades (Ross *et al.* 2000, pp. 101, 111), and loss of pine rockland in the Keys (Ross *et al.* 1994, pp. 144, 151–155). In one Florida Keys pine rockland with an average elevation of 0.89 m (2.9 ft), Ross *et al.* (1994, pp. 149–152) observed an approximately 65 percent reduction in an area occupied by South Florida slash pine over a 70-year period, with pine mortality and subsequent increased proportions of halophytic (salt-loving) plants occurring earlier at the lower elevations. During this same time span, local sea level had risen by 15.0 cm (6.0 in), and Ross *et al.* (1994, p. 152) found evidence of groundwater and soil water salinization. Extrapolating this situation to pine rocklands on the mainland is not straightforward, but suggests that similar changes to species composition could arise if current projections of SLR occur and freshwater inputs are not sufficient to prevent salinization. Furthermore, Ross *et al.* (2009, pp. 471–478) suggested that interactions between SLR and pulse disturbances (*e.g.*, storm surges) can cause vegetation to change sooner than projected based on sea level alone. Effects from vegetation shifts in the pine rockland habitat on the Miami tiger beetle are unknown, but because the beetle occurs in a narrow range and microhabitat parameters are still being studied, vegetation shifts could cause habitat changes or disturbance that would have a negative impact on beetle recruitment and survival. Alexander (1953, pp. 133–138) attributed the demise of pinelands on northern Key Largo to salinization of the groundwater in response to SLR. Patterns of human development will also likely be significant factors influencing whether natural communities can move and persist (IPCC 2008, p. 57; USCCSP 2008, pp. 7-6).

The Science and Technology Committee of the Miami-Dade County Climate Change Task Force (Wanless *et al.* 2008, p. 1) recognized that significant SLR is a very real threat to the near future for Miami-Dade County. In a January 2008 statement, the committee warned that sea level is expected to rise at least 0.9–1.5 m (3–5 ft) within this century (Wanless *et al.* 2008, p. 3). With a 0.9–1.2 m (3–4 ft) rise in sea level (above baseline) in Miami-Dade County: "Spring high tides would be at about 6 to 7 ft; freshwater resources would be gone; the Everglades would be inundated on the west side of Miami-Dade County; the barrier islands would be largely inundated; storm surges would be devastating; landfill sites would be exposed to erosion contaminating marine and coastal environments. Freshwater and coastal mangrove wetlands will not keep up with or offset SLR of 2 ft per century or greater. With a 5-ft rise (spring tides at nearly +8 ft), Miami-Dade County will be extremely diminished" (Wanless *et al.* 2008, pp. 3–4).

Drier conditions and increased variability in precipitation associated with climate change are expected to hamper successful regeneration of forests and cause shifts in vegetation types through time (Wear and Greis 2012, p. 39). Although it has not been well studied, existing pine rocklands have probably been affected by reductions in the mean water table. Climate changes are also forecasted to extend fire seasons and the frequency of large fire events throughout the Coastal Plain (Wear and Greis 2012, p. 43). While restoring fire to pine rocklands is essential to the long-term viability of the Miami tiger beetle (see Factor A discussion, above), increases in the scale, frequency, or severity of wildfires could have negative effects on the species (*e.g.*, if wildfire occurs over the entire area occupied by the two known populations during the adult flight season when adults are present).

To accommodate the large uncertainty in SLR projections, researchers must estimate effects from a range of scenarios. Various model scenarios developed at Massachusetts Institute of Technology (MIT) and GeoAdaptive Inc. have projected possible trajectories of future transformation of the south Florida landscape by 2060, based upon four main drivers: climate change, shifts in planning approaches and regulations, human population change, and variations in financial resources for conservation (Vargas-Moreno and Flaxman 2010, pp. 1–6). The scenarios do not account for temperature, precipitation, or species habitat shifts due to climate change, and no storm surge effects are considered. The current MIT scenarios range from an increase of 0.09–1.00 m (0.3–3.3 ft) by 2060.

Based on the most recent estimates of SLR and the data available to us at this time, we evaluated potential effects of SLR using the current “high” range MIT scenario, as well as comparing elevations of remaining pine rockland fragments and extant occurrences of the Miami tiger beetle. The “high” range (or “worst case”) MIT scenario assumes high SLR (1.0 m (3.3 ft) by 2060), low financial resources, a 'business as usual' approach to planning, and a doubling of human population. Based on this scenario, pine rocklands along the coast in central Miami-Dade County would become inundated. The "new" sea level (1.0 m (3.3 ft) higher) would come up to the edge of pine rockland fragments at the southern end of Miami-Dade County, translating to partial inundation or, at a minimum, vegetation shifts for these pine rocklands. While sea level under this scenario would not overtake other pine rocklands in urban Miami-Dade County, including the known locations for the Miami tiger beetle, changes in the salinity of the water table and soils would surely cause vegetation shifts that may negatively impact the viability of the beetle. In addition, many existing pine rockland fragments are projected to be developed for housing as the human population grows and adjusts to changing sea levels under this "high" range (or "worst case") MIT scenario. Actual impacts may be greater or less than anticipated based upon high variability of factors involved (*e.g.*, SLR, human population growth) and assumptions made in the model.

When simply looking at current elevations of pine rockland fragments and occurrences of the Miami tiger beetle, it appears that an SLR of 1 m (3.3 ft) will inundate the coastal and southern pine rocklands and cause vegetation shifts largely as described above. SLR of 2 m (6.6 ft) appears to inundate much larger portions of urban Miami-Dade County. The western part of urban Miami-Dade County would also be inundated (barring creation of sea walls or other barriers), creating a virtual island of the Miami Rock Ridge. After a 2-m rise in sea level, approximately 75 percent of the remaining pine rockland would still be above sea level but an unknown percentage of these fragments would be negatively impacted by salinization of the water table and soils, which would be exacerbated due to isolation from mainland fresh water flows. Above 2 m (6.6 ft) of SLR, very little pine rockland would remain, with the vast majority either being inundated or experiencing vegetation shifts.

The climate of southern Florida is driven by a combination of local, regional, and global events, regimes, and oscillations. There are three main "seasons": (1) The wet season, which is hot, rainy, and humid from June through October; (2) the official hurricane season that extends 1 month beyond the wet season (June 1 through November 30), with peak season being August and September; and (3) the dry season, which is drier and cooler, from November through May. In the dry season, periodic surges of cool and dry continental air masses influence the weather with short-duration rain events followed by long periods of dry weather.

Climate change may lead to increased frequency and duration of severe storms (Golladay *et al.* 2004, p. 504; McLaughlin *et al.* 2002, p. 6074; Cook *et al.* 2004, p. 1015). Hurricanes and tropical storms can modify habitat (*e.g.*, through storm surge) and have the potential to destroy the only known population of the Miami tiger beetle and its suitable habitat. With most of the historical habitat having been destroyed or modified, the two known remaining populations of the beetle are at high risk of extirpation due to stochastic events.

Alternative Future Landscape Models and Coastal Squeeze

The Miami tiger beetle is anticipated to face major risks from coastal squeeze, which occurs when habitat is pressed between rising sea levels and coastal development that prevents landward movement (Scavia *et al.* 2002, entire; FitzGerald *et al.* 2008, entire; Defeo *et al.* 2009, p. 8; LeDee *et al.* 2010, entire; Menon *et al.* 2010, entire; Noss 2011, entire). Habitats in coastal areas (*i.e.*, Charlotte, Lee, Collier, Monroe, Miami-Dade Counties) are likely the most vulnerable. Although it is difficult to quantify impacts due to the uncertainties involved, coastal squeeze will likely result in losses in habitat for the beetles as people and development are displaced further inland.

Summary of Factor E

Based on our analysis of the best available information, we have identified a wide array of natural and manmade factors affecting the continued existence of the Miami tiger beetle. The beetle is immediately vulnerable to extinction, due to the effects of few remaining small populations, restricted range, and isolation. Aspects of the Miami tiger beetle's natural history (*e.g.*, limited dispersal) and environmental stochasticity (including hurricanes and storm surge) may also contribute to imperilment. Other natural (*e.g.*, changes to habitat, invasive and exotic vegetation) and anthropogenic (*e.g.*, habitat alteration, impacts from humans) factors are also identifiable threats. Climate change, sea-level rise, and coastal squeeze are major concerns. Collectively, these threats have occurred in the past, are impacting the species now, and will continue to impact the species in the future.

Cumulative Effects from Factors A through E

The limited distribution, small population size, few populations, and relative isolation of the Miami tiger beetle makes it extremely susceptible to further habitat loss, modification, degradation, and other anthropogenic threats. The Miami tiger beetle's viability at present is uncertain, and its continued persistence is in danger, unless protective actions are taken. Mechanisms causing the decline of this beetle, as discussed above, range from local (*e.g.*, lack of adequate fire management, vegetation encroachment), to regional (*e.g.*, development, fragmentation, nonnative species), to global influences (*e.g.*, climate change, SLR). The synergistic effects of threats (such as hurricane effects on a species with a limited distribution consisting of just two known populations) make it difficult to predict population viability now and in the future. While these stressors may act in isolation, it is more probable that many stressors are acting simultaneously (or in combination) on the Miami tiger beetle.

Determination

We have carefully assessed the best scientific and commercial information available regarding the past, present, and future threats to the Miami tiger beetle. Habitat loss, degradation, and fragmentation have destroyed an estimated 98 percent of the historical pine rockland habitat in Miami-Dade County, with only two known populations remaining. The threat of habitat loss is continuing from development, inadequate habitat management resulting in vegetation encroachment, and environmental effects resulting from climatic change (see discussions under Factors A and E). Due to the restricted range, small population size, few populations, and relative isolation (see Factor E), collection is a significant threat to the species and could potentially occur at any time (see discussions under Factor B). Additionally, the species is currently threatened by a wide array of natural and manmade factors (see Factor E). Existing regulatory mechanisms do not provide adequate protection for the species (see Factor D). As a result, impacts from increasing threats, singly or in combination, are likely to result in the extinction of the species because the magnitude of threats is high.

The Act defines an endangered species as any species that is "in danger of extinction throughout all or a significant portion of its range" and a threatened species as any species "that is likely to become endangered throughout all or a significant portion of its range within the foreseeable future." We find that the Miami tiger beetle is presently in danger of extinction throughout its entire range based on the severity and immediacy of threats currently affecting the species. The overall range has been significantly impacted because of significant habitat loss, degradation, and fragmentation of pine rockland habitat. Newly proposed development is currently threating the only known population of this species. The fragmented nature of Miami-Dade County's remaining pine rockland habitat and the influx of development around them may preclude the ability to conduct prescribed burns or other beneficial management actions that are needed to prevent vegetation encroachment. The remaining two known, small populations of the Miami tiger beetle appears to occupy relatively small habitat patches, which make the population vulnerable to local extinction from normal fluctuations in population size, genetic problems from small population size, or environmental catastrophes. Limited dispersal abilities in combination with limited habitat may result in local extirpations.

Therefore, on the basis of the best available scientific and commercial information, we propose to list the Miami tiger beetle as an endangered species in accordance with sections 3(6) and 4(a)(1) of the Act. We find that a threatened species status is not appropriate for the Miami tiger beetle because of significant habitat loss (*i.e.*, 98 percent of pine rockland habitat in Miami-Dade County) and degradation; the fact that only two known small populations of the species remain; and the imminent threat of large development projects in the Richmond pine rocklands.

Under the Act and our implementing regulations, a species may warrant listing if it is endangered or threatened throughout all or a significant portion of its range. The threats to the survival of the species occur throughout the species' range and are not restricted to any particular significant portion of that range. Accordingly, our assessment and proposed determination apply to the species throughout its entire range.

Available Conservation Measures

Conservation measures provided to species listed as endangered or threatened under the Act include recognition, recovery actions, requirements for Federal protection, and prohibitions against certain practices. Recognition through listing results in public awareness, and conservation by Federal, State, Tribal, and local agencies; private organizations; and individuals. The Act encourages cooperation with the States and other countries and calls for recovery actions to be carried out for listed species. The protection required by Federal agencies and the prohibitions against certain activities are discussed, in part, below.

The primary purpose of the Act is the conservation of endangered and threatened species and the ecosystems upon which they depend. The ultimate goal of such conservation efforts is the recovery of these listed species, so that they no longer need the protective measures of the Act. Subsection 4(f) of the Act calls for the Service to develop and implement recovery plans for the conservation of endangered and threatened species. The recovery planning process involves the identification of actions that are necessary to halt or reverse the species' decline by addressing the threats to its survival and recovery. The goal of this process is to restore listed species to a point where they are secure, self-sustaining, and functioning components of their ecosystems.

Recovery planning includes the development of a recovery outline shortly after a species is listed and preparation of a draft and final recovery plan. The recovery outline guides the immediate implementation of urgent recovery actions and describes the process to be used to develop a recovery plan. Revisions of the plan may be done to address continuing or new threats to the species, as new substantive information becomes available. The recovery plan also identifies recovery criteria for review of when a species may be ready for downlisting or delisting, and methods for monitoring recovery progress. Recovery plans also establish a framework for agencies to coordinate their recovery efforts and provide estimates of the cost of implementing recovery tasks.

Recovery teams (composed of species experts, Federal and State agencies, nongovernmental organizations, and stakeholders) are often established to develop recovery plans. When completed, the recovery outline, draft recovery plan, and the final recovery plan will be available on our website (*http://www.fws.gov/endangered*), or from the South Florida Ecological Services Office (see **FOR FURTHER INFORMATION CONTACT**).

Implementation of recovery actions generally requires the participation of a broad range of partners, including other Federal agencies, States, Tribes, nongovernmental organizations, businesses, and private landowners. Examples of recovery actions include habitat restoration (*e.g.*, restoration of native vegetation), research, captive propagation and reintroduction, and outreach and education. The recovery of many listed species cannot be accomplished solely on Federal lands because their range may occur primarily or solely on non-Federal lands. To achieve recovery of this species requires cooperative conservation efforts on private, State, and Tribal lands. If the Miami tiger beetle is listed, funding for recovery actions will be available from a variety of sources, including Federal budgets, State programs, and cost share grants for non-Federal landowners, the academic community, and nongovernmental organizations. In addition, pursuant to section 6 of the Act, the State of Florida would be eligible for Federal funds to implement management actions that promote the protection or recovery of the Miami tiger beetle. Information on our grant programs that are available to aid species recovery can be found at: *http://www.fws.gov/grants*.

Although the Miami tiger beetle is only proposed for listing under the Act at this time, please let us know if you are interested in participating in recovery efforts for this species. Additionally, we invite you to submit any new information on this species whenever it becomes available and any information you may have for recovery planning purposes (see **FOR FURTHER INFORMATION CONTACT**).

Section 7(a) of the Act requires Federal agencies to evaluate their actions with respect to any species that is proposed or listed as an endangered or threatened species and with respect to its critical habitat, if any is designated. Regulations implementing this interagency cooperation provision of the Act are codified at 50 CFR part 402. Section 7(a)(4) of the Act requires Federal agencies to confer with the Service on any action that is likely to jeopardize the continued existence of a species proposed for listing or result in destruction or adverse modification of proposed critical habitat. If a species is listed subsequently, section 7(a)(2) of the Act requires Federal agencies to ensure that activities they authorize, fund, or carry out are not likely to jeopardize the continued existence of the species or destroy or adversely modify its critical habitat. If a Federal action may affect a listed species or its critical habitat, the responsible Federal agency must enter into consultation with the Service.

Federal agency actions within the species' habitat that may require conference or consultation or both, as described in the preceding paragraph, include management and any other landscape-altering activities on Federal lands administered by the U.S. Coast Guard, U.S. Army Corps of Engineers, and other Federal agencies; issuance of section 404 Clean Water Act (33 U.S.C. 1251 et seq.) permits by the U.S. Army Corps of

Engineers; and construction and maintenance of roads or highways by the Federal Highway Administration.

The Act and its implementing regulations set forth a series of general prohibitions and exceptions that apply to all endangered and threatened wildlife. The prohibitions of section 9(a)(2) of the Act, codified at 50 CFR 17.21 for endangered wildlife, in part, make it illegal for any person subject to the jurisdiction of the United States to take (includes harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect; or to attempt any of these), import, export, ship in interstate commerce in the course of commercial activity, or sell or offer for sale in interstate or foreign commerce any listed species. Under the Lacey Act (18 U.S.C. 42–43; 16 U.S.C. 3371–3378), it is also illegal to possess, sell, deliver, carry, transport, or ship any such wildlife that has been taken illegally. Certain exceptions apply to agents of the Service and State conservation agencies. 50 CFR 17.31 generally applies the prohibitions for endangered wildlife to threatened wildlife, unless a rule issued under section 4(d) of the Act is adopted by the Service.

We may issue permits to carry out otherwise prohibited activities involving endangered and threatened wildlife species under certain circumstances. Regulations governing permits are codified at 50 CFR 17.22 for endangered species, and at 17.32 for threatened species. With regard to endangered wildlife, a permit must be issued for the following purposes: for scientific purposes, to enhance the propagation or survival of the species, and for incidental take in connection with otherwise lawful activities. There are also certain statutory exemptions from the prohibitions, which are found in sections 9 and 10 of the Act.

Activities Under Section 9

It is our policy, as published in the **Federal Register** on July 1, 1994 (59 FR 34272), to identify, to the maximum extent practicable at the time a species is listed, those activities that would or would not constitute a violation of section 9 of the Act. The intent of this policy is to increase public awareness of the effect of a proposed listing on proposed and ongoing activities within the range of species proposed for listing. Based on the best available information, the following activities involving the Miami tiger beetle (including all of its metamorphic life stages) may potentially result in a violation of section 9 of the Act; this list is not comprehensive:

(1) Unauthorized possession, collecting, trapping, capturing, killing, harassing, sale, delivery, or movement, including interstate and foreign commerce, or harming or attempting any of these actions, at any life stage without a permit (research activities where Miami tiger beetles are surveyed, captured (netted), or collected will require a permit under section 10(a)(1)(A) of the Act).

(2) Incidental take without a permit pursuant to section 10(a)(1)(B) of the Act.

(3) Sale or purchase of specimens, except for properly documented antique specimens of this taxon at least 100 years old, as defined by section 10(h)(1) of the Act.

(4) Unauthorized use of pesticides/herbicides that results in take.

(5) Release of biological control agents that attack any life stage.

(6) Discharge or dumping of toxic chemicals, silts, or other pollutants into, or other alteration of the quality of, habitat supporting the Miami tiger beetles that result in take.

(7) Unauthorized activities (*e.g.*, plowing; mowing; burning; herbicide or pesticide application; land leveling/clearing; grading; disking; soil compaction; soil removal; dredging; excavation; deposition of dredged or fill material; erosion and deposition of sediment/soil; grazing or trampling by livestock; minerals extraction or processing; residential, commercial, or industrial developments; utilities development; road construction; or water development and impoundment) that take eggs, larvae, or adult Miami tiger beetles or that modify Miami tiger beetle habitat in such a way that take Miami tiger beetles by adversely affecting their essential behavioral patterns, including breeding, foraging, sheltering, or other life functions. Otherwise lawful activities that incidentally take Miami tiger beetles, but have no Federal nexus, will require a permit under section 10(a)(1)(B) of the Act.

Questions regarding whether specific activities would constitute a violation of section 9 of the Act should be directed to the South Florida Ecological Services Office (see **FOR FURTHER INFORMATION CONTACT**).

Critical Habitat

Section 3(5)(A) of the Act defines critical habitat as “(i) the specific areas within the geographical area occupied by the species, at the time it is listed . . . on which are found those physical or biological features (I) Essential to the conservation of the species and (II) which may require special management considerations or protection; and (ii) specific areas outside the geographical area occupied by the species at the time it is listed . . . upon a determination by the Secretary that such areas are essential for the conservation of the species.” Section 3(3) of the Act (16 U.S.C. 1532(3)) defines the terms “conserve,” “conserving,” and “conservation” to mean “to use and the use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to this Act are no longer necessary.”

Section 4(a)(3) of the Act, as amended, and implementing regulations (50 CFR 424.12), require that, to the maximum extent prudent and determinable, the Secretary shall designate critical habitat at the time the species is determined to be an endangered or threatened species. Our regulations (50 CFR 424.12(a)(1)) state that the designation of critical habitat is not prudent when one or both of the following situations exist:

(1) The species is threatened by taking or other human activity, and identification of critical habitat can be expected to increase the degree of threat to the species, or

(2) Such designation of critical habitat would not be beneficial to the species.

There is currently an imminent threat of take attributed to collection or vandalism described under Factor B, above, for the species. However, it is believed that the majority of occurrences of Miami tiger beetles are well known. Although the location of the new population is less well known, awareness of this population is increasing in the natural resource community. We believe that the benefits of designating critical habitat will outweigh the risks associated with increased collection from mapping and identifying critical habitat.

Therefore, in the absence of finding that the designation of critical habitat would increase threats to a species, if there are any benefits to a critical habitat designation, a finding that designation is prudent is warranted. Here, the potential benefits of designation include: (1) Triggering consultation under section 7 of the Act, in new areas for actions in which there may be a Federal nexus where it would not otherwise occur because, for example, it is unoccupied; (2) focusing conservation activities on the most essential features and areas; (3) providing educational benefits to State or county governments or private entities; and (4) preventing people from causing inadvertent harm to these species.

Because we have determined that the designation of critical habitat will not likely increase the degree of threat to the species and may provide some measure of benefit, we determine that designation of critical habitat may be prudent for the Miami tiger beetle.

Our regulations (50 CFR 424.12(a)(2)) further state that critical habitat is not determinable when one or both of the following situations exists: (1) Information sufficient to perform required analysis of the impacts of the designation is lacking; or (2) the biological needs of the species are not sufficiently well known to permit identification of an area as critical habitat. On the basis of a review of available information, we find that critical habitat for the Miami tiger beetle is not determinable because the specific information sufficient to perform the required analysis of the impacts of the designation is currently lacking. Specifically, we are still in the process of obtaining all the information needed to properly evaluate the economic impacts of designation.

Required Determinations

Clarity of the Rule

We are required by Executive Orders 12866 and 12988 and by the Presidential Memorandum of June 1, 1998, to write all rules in plain language. This means that each rule we publish must:

(1) Be logically organized;

(2) Use the active voice to address readers directly;

(3) Use clear language rather than jargon;

(4) Be divided into short sections and sentences; and

(5) Use lists and tables wherever possible.

If you feel that we have not met these requirements, send us comments by one of the methods listed in the **ADDRESSES** section. To better help us revise the rule, your comments should be as specific as possible. For example, you should tell us the numbers of the sections or paragraphs that are unclearly written, which sections or sentences are too long, the sections where you feel lists or tables would be useful, etc.

National Environmental Policy Act (42 U.S.C. 4321 et seq.)

We have determined that environmental assessments and environmental impact statements, as defined under the authority of the National Environmental Policy Act, need not be prepared in connection with listing a species as an endangered or threatened species under the Endangered Species Act. We published a notice outlining our reasons for this determination in the **Federal Register** on October 25, 1983 (48 FR 49244).

References Cited

A complete list of references cited in this rulemaking is available on the Internet at *http://www.regulations.gov* and upon request from the South Florida Ecological Services Office (see **FOR FURTHER INFORMATION CONTACT**).

Authors

The primary authors of this proposed rule are the staff members of the South Florida Ecological Services Office.

List of Subjects in 50 CFR Part 17

Endangered and threatened species, Exports, Imports, Reporting and recordkeeping requirements, Transportation.

Proposed Regulation Promulgation

Accordingly, we propose to amend part 17, subchapter B of chapter I, title 50 of the CFR, as set forth below:

PART 17—ENDANGERED AND THREATENED WILDLIFE AND PLANTS

1. The authority citation for part 17 continues to read as follows:

Authority: 16 U.S.C. 1361-1407; 1531-1544; and 4201-4245, unless otherwise noted.

2. Amend § 17.11(h) by adding an entry for "Beetle, Miami tiger" to the List of Endangered and Threatened Wildlife in alphabetical order under INSECTS to read as follows:

§ 17.11 Endangered and threatened wildlife.

* * * * *

(h) * * *

Species		Historic range	Vertebrate population where endangered or threatened	Status	When listed	Critical habitat	Special rules
Common name	**Scientific name**						
* * * * * * *							
INSECTS							
* * * * * * *							
Beetle, Miami tiger	*Cicindelidia floridana*	U.S.A. (FL)	NA	E		NA	NA
* * * * * * *							

* * * * *

Dated: December 10, 2015_________________________________

Signed: ___________________________________

Stephen Guertin

Acting Director, U.S. Fish and Wildlife Service

Billing Code 4333–15–P

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