(C) Bridge and culvert replacement/removal projects that remove migration barriers (*e.g.,* collapsing, blocked, or perched culverts) or generally allow for improved upstream and downstream movements of Kentucky arrow darters while maintaining normal stream flows, preventing bed and bank erosion, and improving habitat conditions for the species.

(D) Repair and maintenance of U.S. Forest Service concrete plank stream crossings on the Daniel Boone National Forest (DBNF) that allow for safe vehicle passage while maintaining instream habitats, reducing bank and stream bed erosion and instream sedimentation, and improving habitat conditions for the species. These concrete plank crossings have been an effective stream crossing structure on the DBNF and have been used for decades. Over time, the planks can be buried by sediment, undercut during storm events, or simply break down and decay. If these situations occur, the DBNF must make repairs or replace the affected plank.

* * * * *

Dated: September 19, 2016.

Stephen Guertin,

Acting Director, U.S. Fish and Wildlife Service.

[FR Doc. 2016–23545 Filed 10–4–16; 8:45 am]

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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; Endangered Species Status for the Miami Tiger Beetle (Cicindelidia floridana)

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Final rule.

SUMMARY: We, the U.S. Fish and Wildlife Service (Service), determine endangered species status under the Endangered Species Act of 1973 (Act), as amended, for the Miami tiger beetle (*Cicindelidia floridana*), a beetle species from Miami-Dade County, Florida. The effect of this regulation will be to add this species to the Federal List of Endangered and Threatened Wildlife and extend the Act's protections to this species.

DATES: This rule becomes effective November 4, 2016.

ADDRESSES: This final rule is available on the internet at *http://www.regulations.gov* and at *http://www.fws.gov/verobeach/.* Comments and materials we received, as well as supporting documentation we used in preparing this rule, are available for public inspection at *http://www.regulations.gov.* Comments, materials, and documentation that we considered in this rulemaking will be available by appointment, during normal business hours at: U.S. Fish and Wildlife Service, South Florida Ecological Services Office, 1339 20th Street, Vero Beach, FL 32960; telephone 772–562–3909; facsimile 772–562–4288.

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 Endangered Species Act, a species may warrant protection through listing if it is endangered or threatened throughout all or a significant portion of its range. Listing a species as an endangered or threatened species can only be completed by issuing a rule.

The basis for our action. Under the Endangered Species 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, and 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).

Peer review and public comment. We sought comments from independent specialists to ensure that our designation is based on scientifically sound data, assumptions, and analyses. We invited these peer reviewers to comment on our listing proposal. We also considered all other comments and information received during the comment period.

Previous Federal Action

Please refer to the proposed listing rule for the Miami tiger beetle (80 FR 79533), published on December 22, 2015, for a detailed description of previous Federal actions concerning this species. We will also be proposing a designation of critical habitat for the Miami tiger beetle under the Act in the near future.

Background

The discussion below incorporates revisions to the discussion in the proposed listing rule for the Miami tiger beetle (80 FR 79533; December 22, 2015) on taxonomy, distribution, and population estimates and status based on internal and peer review and public comments. Please refer to the proposed listing rule for discussion of the species' description, habitat, and biology.

Taxonomy

Determining the taxonomy of a plant or animal and the relationship that this plant or animal has with similar, closely related members of its taxon involves the review of comparative morphology and descriptive characteristics, geographic range and separation of members, reproductive capabilities between members, and the genetic distinctiveness between them. Together the available information is assessed to determine the validity of a species.

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*), scabrous 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 genetic evidence (Pearson *et al.* 2015, p. 16).

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 scabrous 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 scabrous 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 scabrous 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 scabrous 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). These habitats also provide different larval microhabitat, which has been recognized as an important factor that separates species (T. Schultz, 2016, pers. comm.).

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 scabrous 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).

Genetics information is also commonly used to identify taxonomic relatedness. Genetic analyses for the Miami tiger beetle to date are limited to one non-peer-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, scabrous 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), 2016, p. 1).

The ITIS 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, 2016, p. 1). Both the ITIS (2016, p. 1) and Bousquet (2012, p. 313) continue to use the former genus, *Cicindela* (see discussion above). The Florida Natural Areas Inventory (FNAI) (2016, p. 16) and NatureServe (2015, p. 1) also accepts the Miami tiger beetle's taxonomic status as a species; however, FNAI uses 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 (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 sites owned by Miami-Dade County 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. Given the lack of recorded collection of the species for nearly 70 years, it may have always had a localized distribution (Schultz, 2016, pers. comm.).

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 publicly 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, the Miami tiger beetle is known to occur in only two separate locations within pine rockland habitat in Miami-Dade County. The Richmond population occurs on four contiguous parcels within 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) (see Table 1 in *Supporting Documents* on *http://www.regulations.gov*). The second population, which was recently identified (September 2015) is within approximately 5.0 km (3.1 mi) of the Richmond population and separated by urban development (D. Cook, 2015a, pers. comm.). 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).

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.

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 two to three 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). 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 two to three 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, 2015b, 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 location. 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 2015a, 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 2015a, 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 (two cohorts of adults emerge during their active season) (Knisley 2015a, p. 10). Knisley (2015a, p. 10) suggests that actual numbers of adult Miami tiger beetles could be two to three 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 for 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 of Zoo B 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 (2015c, 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 below trees, which made the identification of previous open patches with adults difficult.

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 (2016, 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 Comments and Recommendations

In the proposed rule published on December 22, 2015 (80 FR 79533), we requested that all interested parties submit written comments on the proposal by February 22, 2016. We also contacted appropriate Federal and State agencies, scientific experts and organizations, and other interested parties and invited them to comment on the proposal. Newspaper notices inviting general public comment were published in the *Miami Herald.* We held a public hearing on January 13, 2016.

Peer Reviewer Comments

In accordance with our peer review policy published on July 1, 1994 (59 FR 34270), we solicited expert opinion from seven knowledgeable individuals with scientific expertise that included familiarity with tiger beetles and their habitat, biological needs, and threats. We appreciate the responses received from five of the peer reviewers.

We reviewed all comments received from the peer reviewers for substantive issues and new information regarding the listing of the Miami tiger beetle. All peer reviewers supported the endangered listing, and four of the five specifically stated that the best available scientific information was used in the proposed listing. The peer reviewers concurred with our methods and conclusions and provided additional information, clarifications, and suggestions to improve the final rule. Peer reviewer comments are addressed in the following summary and incorporated into the final rule as appropriate.

(1) *Comment:* One peer reviewer recommended the immediate use of fire management in pine rockland habitat for the Miami tiger beetle.

Our Response: We also recognize, as discussed below (see Summary of Factors Affecting the Species), the need for better land management, including the use of prescribed fire, additional survey and life-history data, further investigation into laboratory rearing for possible reintroduction, more extensive genetic analysis, and designation of critical habitat.

(2) *Comment:* One peer reviewer stated that one of the most relevant ecological factors that separate tiger beetle species is soil type and microhabitat of the larvae, and the limestone substrate of the Miami tiger beetle as opposed to the sandy habitats of the scabrous tiger beetle (*C. scabrosa*) reflect subsequent adaptation to a local habitat following a geographic separation.

Our Response: We have modified the language under *Taxonomy* above to incorporate this statement regarding larval microhabitat.

(3) *Comment:* One peer reviewer stated that the lack of collection of the Miami tiger beetle for decades after its initial discovery may indicate that it has always been very localized in its distribution.

Our Response: We have modified the language under *Distribution* above to incorporate this statement regarding a localized distribution.

(4) *Comment:* One peer reviewer stated that development in and around Miami tiger beetle habitat will present a decline to habitat quality through runoff from structures.

Our Response: We have modified *Factor A* below to incorporate this information.

(5) *Comment:* One peer reviewer stated that the negative impact of pesticides may be increased with the spread of the Zika virus.

Our Response: We have incorporated this information under *Factor E* below.

Comments From States

The Miami tiger beetle occurs only in Florida, and we received one comment letter from the Florida Fish and Wildlife Conservation Commission (FWC). FWC stated its plans to continue working with stakeholders to assess known and potential Miami tiger beetle habitat, conduct surveys, and advise on issues relating to Miami tiger beetle conservation and habitat management.

Comments From the Public

During the comment period for the proposed listing rule, we received a total of 73 comments from local governments, nongovernmental organizations, and private citizens. Of these 73 comments, 65 indicated support of the proposed listing. We appreciate all comments and have incorporated them into the final rule or responded to them below, as appropriate.

(6) *Comment:* Several commenters questioned the taxonomy as a result of Choate's work, use of best scientific and commercial data, morphological characteristics, and seasonality of the Miami tiger beetle.

Our Response: In accordance with section 4 of the Act, we are required to make listing determinations on the basis of the best scientific and commercial data available. Further, our Policy on Information Standards under the Act (published in the **Federal Register** on July 1, 1994 (59 FR 34271)), the Information Quality Act (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001 (Pub. L. 106–554; H.R. 5658)), and our associated Information Quality Guidelines (*www.fws.gov/informationquality/*), provide criteria and guidance, and establish procedures to ensure that our decisions are based on the best scientific data and commercial data available.

The *Taxonomy* section above discusses the taxonomic designation of the Miami tiger beetle. The most currently peer-reviewed scientific information confirms that the Miami tiger beetle is a full species, and this taxonomic designation is used by the scientific community (Brzoska *et al.* 2011, entire; Bousquet 2012, p. 313; Pearson *et al.* 2015, p. 138; ITIS, 2016, p. 1; FNAI 2016, p. 16; NatureServe 2015, p. 1). The works referenced by commenters (Choate 1984 and 2003) pre-date the rediscovery of the Miami tiger beetle in 2007 and do not include the most currently accepted taxonomic standing of the species. Prior to the rediscovery, the species had not been observed since its original collection in 1934. Choate did not examine specimens of the Miami tiger beetle when he synonymized it with the scabrous tiger beetle (NatureServe 2015, p. 1).

Brzoska *et al.* (2011, entire) established taxonomic criteria and did not intend for color and other morphological features to be used in isolation as intended in the taxonomic criteria set. Color and maculation are commonly used to identify tiger beetles, especially in combination with geographic range and habitat (Knisley and Schultz 1997, pp. 5–10; Pearson *et al.* 2015, pp. 19–20). Color, morphological features (post median marginal spot, middle band, and apical (apex, the top or highest part forming a point) lunule (crescent-shaped), distribution, seasonality, and habitat type of the Miami tiger beetle are only used in combination to differentiate it from the scabrous tiger beetle (Brzoska *et al.* 2011, entire), so minor overlap in individual features, such as post median marginal spot as noted by the commenters, is not necessarily a uniquely identifying feature until taken into consideration with the other identifying factors.

Regarding color, all specimens of the Miami tiger beetle observed by Brzoska *et al.* (2011, entire) were bright metallic green dorsally on the head, pronotum, and elytron, while the scabrous tiger beetle is metallic black dorsally, with only a few individuals having a greenish head and pronotum (prominent plate-like structure that covers all or part of the thorax). Likewise, no Miami tiger beetles had a thick lunule or a middle band. This suite of characteristics identified by Brzoska *et al.* (2011, entire), clearly differentiate the Miami tiger beetle from the scabrous tiger beetle. Since Brzoska *et al.* (2011, entire), there has been no debate in the scientific literature about the taxonomic characters used to identify the Miami tiger beetle as a species, and to our knowledge all literature since Brzoska *et al.* (2011, entire) recognize it as a valid species (Bousquet 2012, p. 313; Pearson *et al.* 2015, p. 138; ITIS 2016, p. 1; FNAI 2016, p. 16; NatureServe 2015, p. 1).

Finally, we agree that there is some overlap in the adult activity period between the Miami tiger beetle and its closely related sister species, the scabrous tiger beetle; however, the adult flight season for the Miami tiger beetle extends into October, while that of the scabrous tiger beetle, which is far more widespread and has been collected on a more routine basis, does not. The Miami tiger beetle has been observed during October surveys for three separate years (2008, 2009, and 2011). Seasonality is only one of several factors used to differentiate the Miami tiger beetle from the scabrous tiger beetle.

(7) *Comment:* Three commenters stated that the genetic study on the Miami tiger beetle should not be rejected.

Our Response: We agree that distinct differences in DNA can be helpful in delineating species. The single genetic study that is available on the Miami tiger beetle was used in the listing determination process and is discussed in *Taxonomy* above. This genetic study concluded that the Miami, Highlands, scabrous, and eastern pinebarrens tiger beetles are all closely related, recently evolved, and not clearly separable by the mtDNA analysis conducted. This finding is not uncommon among closely related *Cicindela* groups (Woodcock and Knisley 2009, entire; Knisley 2011a, p. 14). The lack of genetic distinctiveness in the study does show that the mtDNA markers used (cytochrome b and cytochrome oxidase subunit 1) were not in agreement with the morphological, seasonal, ecological, and geographic criteria that have been used to identify the species (Choate 1984, entire; Brzoska *et al.* 2011, entire), but this finding is not necessarily an indication that they are not separate species.

Determining the taxonomy of a species and its evolutionary relationships with similar, closely related members of its taxon involves the review of comparative morphology and descriptive characteristics, geographic range and separation of members, reproductive capabilities between members, and the genetic distinctiveness between them. Together the available information is assessed to determine the validity of a species. This determination is not based on any one single factor in isolation, but rather on the weight of evidence from the suite of factors available. The identifying criteria that clearly define the sister species used in the genetic study (Choate 1984, entire; Brzoska *et al.* 2011, entire) have been peer reviewed and are accepted in the scientific literature (Bousquet 2012, p. 313; Pearson *et al.* 2015, p. 138; ITIS 2016, p. 1; FNAI 2016, p. 16; NatureServe 2015, p. 1). As suggested by one peer reviewer, an analysis using nuclear DNA, with multiple different genes, instead of the two that were used in the genetic analysis, may be more useful in the case of these closely related sister species.

(8) *Comment:* Five commenters provided information on observations of Miami tiger beetles at the following locations: University of Miami, Zoo Miami, Larry and Penny Thompson Park, Gold Coast Railroad Museum, U.S. Coast Guard, and an undisclosed location, miles away from the Richmond Pine Rocklands.

Our Response: The proposed rule listed the Miami tiger beetle as occurring on Zoo Miami, the University of Miami CSTARS Campus, Larry and Penny Thompson Park, the U.S. Coast Guard, and an undisclosed location within approximately 5 km (3 mi) of the Richmond Pine Rocklands. The Gold Coast Railroad Museum was not included in the proposed rule because it is the first reported observation of Miami tiger beetles. Since receiving this information, we have searched scientific and commercial data to validate this location. The Gold Coast Railroad Museum parcel is within close proximity to known occupied sites within the Richmond Pine Rocklands. Because of the contiguous habitat with few barriers to dispersal, many of the parcels within the Richmond Pine Rocklands are suitable or potentially suitable for the Miami tiger beetle.

(9) *Comment:* Two commenters expressed concern that the proposed rule lacked specificity in range or habitat boundaries for the Miami tiger beetle, which presents uncertainty for anyone planning development within the range of the species. So that the economic consequence of the rule can be appropriately evaluated, one commenter requested that the Service collect more survey data to better delineate habitat boundaries and make this data available for review and comment, prior to publication of a final rule.

Our Response: Under the Endangered Species Act, listing determinations must be made based on the best available scientific and commercial information. Economic and other potential impacts are not considered in the listing determination, but rather in the consideration of exclusion of areas from critical habitat under section 4(b)(2) of the Act, when in the process of designating critical habitat for a species. As discussed below (see Critical Habitat), we have found that critical habitat is not determinable at this time.

The *Distribution* section, above, discusses the historical and current range of the Miami tiger beetle. Additionally, we are continuing to study and define the specificity in range and habitat boundaries for the Miami tiger beetle.

(10) *Comment:* One commenter stated that the proposed rule did not appropriately capture the single-season survey data points collected by Miami-Dade County and Fairchild Tropical Botanic Garden, which provide some perspective on the population of the Miami tiger beetle in the Richmond Pine Rocklands.

Our Response: We received the survey data points collected by Miami-Dade County and others on January 29, 2016, after the proposed listing rule publication on December 22, 2015. Our description of the species' extant occurrences within the Richmond Pine Rocklands in the *Distribution* section above is consistent with the new data presented to us by Miami-Dade County (*i.e.,* the Miami tiger beetle is known from four contiguous parcels within the Richmond Pine Rocklands: Zoo Miami Pine Rockland Preserve, Larry and Penny Thompson Park, University of Miami's Center for Southeastern Tropical Advanced Remote Sensing, and U.S. Coast Guard).

(11) *Comment:* One commenter stated that we incorrectly reported that no robber flies have been observed in areas where the Miami tiger beetles occur.

Our Response: We have revised *Factor C* below to include observations of potential predators, such as robber flies.

(12) *Comment:* One commenter recommended 12 pine rockland sites throughout Miami-Dade County be thoroughly surveyed for the Miami tiger beetle.

Our Response: We support further surveys for the species at sites throughout Miami-Dade County and appreciate the list provided of areas to target.

(13) *Comment:* Two commenters stated that the range of the Miami tiger beetle is unknown and improperly assumed to be limited. Both questioned why we did not reference Choate's (2003) field guide, which lists the scabrous tiger beetle as occurring in Miami-Dade County.

Our Response: Since Choate's published work considered the Miami tiger beetle a synonym for the scabrous tiger beetle, then it is logical that he listed the distribution as within Miami-Dade County. We used the more recent publication by Brzoska *et al.* (2011, entire) that elevated the Miami tiger beetle to species and is widely accepted in the scientific literature (Bousquet 2012, p. 313; Pearson *et al.* 2015, p. 138; ITIS 2016, p. 1; FNAI 2016, p. 16; NatureServe 2015, p. 1).

(14) *Comment:* Two commenters stated that the surveying efforts have been inadequate to conclude that the Miami tiger beetle is rare.

Our Response: Surveys (during the summers of 2008 and 2010) for the Miami tiger beetle have included 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). To date, the Miami tiger beetle is known to occur in only two small populations: The Richmond Pine Rocklands and an undisclosed pine rockland within 5 km (3.1 mi) of the Richmond population and separated by urban development. Limitations to surveys are noted above in *Population Estimates and Status.*

(15) *Comment:* Four of the comments received raised a question about the habitat of the type locality.

Our Response: The original description of the Miami tiger beetle (Cartwright 1939, p. 364) provided no detailed information regarding habitat type, other than being in Miami, Florida. Based on later correspondence between tiger beetle researchers and the collector of the type specimen, the general area of the collection was narrowed down to the vicinity of Gratigny Road and present-day Barry University (Brzoska *et al.* 2011, pp. 1–2). This general area was just north (approximately 2.2 km (1.4 mi)) of the northern extent of the pine rocklands on the Miami Rock Ridge in the 1940s (Davis 1943, entire), approximately 10 years after the collection from the type locality. In the 1980s and 1990s, collectors did look for the species in this general location, but this area was fully developed, with no remaining natural habitat. Based on the habitat types of the other closely related *Cicindelidia* that occur in Florida, it was assumed that the Miami tiger beetle, too, likely occupied scrub habitats. The species was then rediscovered in 2007 from pine rockland habitat. Based on historical photos and documents on Barry University (*http://www.barry.edu/about/history/historic-photo-tour/* [accessed April 27, 2016]; Rice 1989, pp. 7, 10), there is evidence that the land currently occupied by Barry University had pine habitat with abundant pine trees and sandy soils. While this information is not irrefutable proof that it was pine rockland habitat, this area is consistent with the habitat type at the known currently occupied locations.

(16) *Comment:* One commenter stated that data do not support the conclusion that collection is a threat to the Miami tiger beetle.

Our Response: Based on data from other insects, including tiger beetles, 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. Since publication of the proposed rule, we have received information on known unpermitted collection of Miami tiger beetles (Wirth, 2016a, pers. comm.). This new information is incorporated under *Factor B* below.

(17) *Comment:* One commenter expressed concern that disease and predation was not identified as a threat for the Miami tiger beetle.

Our Response: This topic is addressed under *Factor C.* below. We concluded that potential impact from predators or parasites to the Miami tiger beetle is unknown at this time, and, therefore it was not identified as a threat in the listing determination. However, *Factor C* below has been updated to include new observations on potential predators at a location known to have Miami tiger beetles.

(18) *Comment:* One commenter stated that existing regulatory mechanisms are adequate to protect the Miami tiger beetle, citing existing critical habitat for other listed species.

Our Response: These topics are discussed under *Factor D* below. The Miami tiger beetle is far rarer (*i.e.,* fewer populations with fewer individuals within a limited distribution) than any of the other listed species with critical habitat that occur within pine rocklands in Miami-Dade County. As an unlisted species, the Miami tiger beetle is afforded limited protection from sections 7 and 10 of the Act based on its co-occurrence with listed species or their critical habitat; however, effects determinations and minimization and avoidance criteria for any of these listed species are unlikely to be fully protective. Critical habitat designations for other species also would not afford the beetle protections from take.

(19) *Comment:* One commenter stated that Miami-Dade County's regulatory and land protection programs protect Miami tiger beetle habitat. The commenter also specified that county's Environmentally Endangered Lands (EELs) program should be included under *Factor A.*

Our Response: This topic, including EELs, is addressed under *Factor D* below. Because Miami-Dade County's Natural Forested Communities (NFCs) designation allows for partial development of pine rockland habitat and there is known unpermitted development and destruction of pine rockland that continues to occur, the regulation is not fully protective against loss of Miami tiger beetles or their habitat. The county's EELs program funds the acquisition and maintenance of pine rockland habitat. Because these lands are not burned as frequently as needed to maintain suitable beetle habitat, they are not included in the discussion under *Factor A, Conservation Efforts to Reduce the Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range.* We have incorporated this clarification into the final rule under *Factor D* below.

(20) *Comment:* One commenter stated that listing could be counter-productive to conducting valuable prescribed burns and habitat management by the Florida Forest Service.

Our Response: We agree that habitat management, including fire break and trail maintenance, prescribed fire, and mechanical and chemical treatment, is highly valuable for the Miami tiger beetle, but disagree that listing could be counter-productive to implementing prescribed burns or other habitat management activities by the Florida Forest Service. The Act requires us to make a determination using the best available scientific and commercial data after taking into account those efforts, if any, being made by any State, or any political subdivision of a State to protect such species, whether by predatory control, protection of habitat and food supply, or other conservation practices, within any area under its jurisdiction. Further, the listing of a species does not obstruct the development of conservation agreements or partnerships to conserve the species. Once a species is listed as either endangered or threatened, the Act provides many tools to advance the conservation of listed species. Conservation of listed species in many parts of the United States is dependent upon working partnerships with a wide variety of entities, including the voluntary cooperation of non-Federal landowners.

(21) *Comment:* One commenter stated that the best available science does not indicate that few, small, isolated populations are a threat for the Miami tiger beetle. They concluded that the Miami tiger beetle can persist in the long term with relatively small populations, and that we fail to explain

why the Miami tiger beetle requires a different population target than other beetles.

Our Response: We acknowledge that populations of some tiger beetle species (*e.g.,* northeastern beach, puritan, and Highlands tiger beetles) are able to persist with low population size, while other populations (*e.g.,* Coral Pink Sand Dunes tiger beetles) have been extirpated. One peer reviewer stated that, given the small population sizes, the Miami tiger beetle could be extirpated by environmental fluctuations. Another peer reviewer stated that the vulnerability of the Miami tiger beetle is clearly established in the proposed rule due to the few remaining small populations and little remaining habitat. Given that the Miami tiger beetle is known only from two remaining isolated populations with few individuals, any significant decrease in the population size could easily result in extinction of the species. This issue is discussed under *Factor E,* below.

The proposed rule set no specific population target for the Miami tiger beetle. The species is considered rarer than any of the listed tiger beetle species (Knisley *et al.* 2014, p. 106). In an evaluation on the status of 62 tiger beetles in the United States, the Miami tiger beetle was considered as one of two tiger beetles most in danger of extinction (Knisley *et al.* 2014, p. 93). Florida Natural Areas Inventory (2016, p. 16) considered the species extremely vulnerable to extinction. One peer reviewer stated that the Miami tiger beetle is probably the most endangered species of tiger beetle in North America. Survey data to date indicate that the two populations exist in extremely low numbers. This topic is discussed under *Population Estimates and Status* above.

(22) *Comment:* One commenter stated that pesticide exposure in the Richmond Pine Rocklands is largely mitigated by current efforts to protect the Bartram's scrub-hairstreak butterfly. The commenter states that we fail to present the differing opinion on pesticides from Knisley (2014).

Our Response: We acknowledge that Miami-Dade Mosquito Control's (MDMCs) recent implementation of truck-based spray buffers around critical habitat for the Bartram's scrub-hairstreak butterfly have greatly reduced pesticide exposure to the Miami tiger beetle, and mosquito control is currently not considered a major threat for the known populations at this time. However, the current spray buffers are not regulations and are subject to change based on human health concerns, which is likely with the spread of the Zika virus as pointed out by one peer reviewer (see peer review comment (5) above). In addition, if the Miami tiger beetle was found to occur on habitat that is not protected by the butterfly's critical habitat, then exposure is possible. This topic is discussed under *Factor E,* below.

Regarding the Service not disclosing a differing opinion by Knisley (2014), it is unclear which Knisley (2014) opinion is referenced by the commenter. The supplemental documents provided by the commenter do not include a Knisley (2014) reference that addresses pesticides. Knisley's (2015a, pp. 15–16) species assessment on the Miami tiger beetle, which was modified from a Service species assessment, identified pesticides as a potential threat.

(23) *Comment:* One commenter stated that our analysis on the threat of climate change failed to present evidence on how the Miami tiger beetle is affected, since it has survived operations of a former naval air station, hurricanes, and operations by Zoo Miami. In addition, the commenter stated that, under most climate change predictions, Miami-Dade County's efforts should protect the pine rockland habitat from saltwater intrusion and must be included as the best available data.

Our Response: We agree that the Miami tiger beetle has survived operations of a former naval air station, hurricanes, and operations by Zoo Miami; however, we do not know the impact of these events on the Miami tiger beetle, because no surveys were conducted until after its rediscovery in 2007. All of the projected climate change scenarios indicate negative effects on pine rockland habitat throughout Miami-Dade County. This includes everything from rising temperatures, increased storm frequency and severity, changes in rainfall patterns, rising sea levels, and ''coastal squeeze,'' which occurs when the habitat is pressed between rising sea levels and coastal development. Even before projected inundation, pine rocklands are likely to undergo transitions including increased salinity in the water table and soils, which would cause vegetation shifts and potential impacts to the beetle. This issue is addressed in *Factor E* below. The commenter did not provide a reference to support its statement that Miami-Dade County's efforts should protect the pine rockland habitat from saltwater intrusion. Based on the best available scientific and commercial data available, we consider climate change a threat to the Miami tiger beetle.

(24) *Comment:* One commenter identified an editorial error under *Factor A* of the proposed rule (80 FR 79533, December 22, 2015; page 79540), which states that the two known populations of the Miami tiger beetle occur within the Richmond Pine Rocklands.

Our Response: We acknowledge that this was an editorial error, as the Miami tiger beetle is known from two populations, only one of which is found within the Richmond Pine Rocklands. We have revised this text under *Factor A,* below.

(25) *Comment:* One commenter stated that the proposed listing rule failed to present the positive examples of using prescribed fire in an urban landscape in citations from Snyder and URS. The commenter pointed out that the URS citation discussed the necessity of prescribed fire to avoid catastrophic risk to surrounding property, including homes, and even loss of life.

Our Response: We have incorporated these concepts under *Factor A* below.

(26) *Comment:* One commenter stated that the Service has been presented with the boundary limits of the proposed Miami Wilds development.

Our Response: We agree that the proposed boundary limits of the proposed Miami Wilds development have been presented to us. However, the statement in the proposed rule under *Factor A,* below, that plans have yet to be finalized, is accurate, since no formal review of the project has been initiated by the proposed applicant.

(27) *Comment:* One commenter expressed concern that routine operational maintenance in existing and potential future transmission and distribution right-of-ways (ROW), such as but not limited to vegetation management and power restoration, may be limited or hindered. The commenter requested that ''utilities development'' be excluded from the section 9 prohibited actions and that language be added indicating that permits will not be required for ROW maintenance activities.

Our Response: This type of request can be covered under a rule issued under section 4(d) of the Act, which allows for some ''take'' of a threatened species when the overall outcome of the allowed actions are ''necessary and advisable to provide for the conservation of the species.'' However, a special rule may not be promulgated for species listed as endangered, such as the Miami tiger beetle.

We strongly encourage that anyone conducting activities, including utilities development and maintenance on lands potentially supporting Miami tiger beetles to consult with the Service on their activities to ensure they do not jeopardize the continued survival and recovery of the beetle and that incidental take may be authorized. The Miami tiger beetle is one of several federally listed species that occurs in Miami-Dade County. Consultation could be done on a programmatic basis for power restoration and routine maintenance of ROWs for all listed species.

(28) *Comment:* Three comments received addressed the FWC's biological status review of the Miami tiger beetle. Two of the comments questioned how the FWC and Service would coordinate efforts. One of the commenters stated that the FWC should take the lead without duplication of efforts at the Federal level.

Our Response: It is our policy to coordinate with the FWC on all proposed and final listings, and we will continue to do so for all future actions. As stated in the Previous Federal Actions section of the proposed rule, the Service was petitioned to list the Miami tiger beetle. The Service's listing process and the Commission's biological status review are two separate and independent actions. However, we have incorporated language under *Factor D* below to reflect that the FWC was requested to undertake a biological status review on the Miami tiger beetle and is currently doing so.

(29) *Comment:* One commenter requested that any underlying data that were used in the proposed rule (*e.g.*, field notes; photographs with notes on use of lighting, equipment, filters, or adjustments; any statistical analyses, collection, and laboratory data from genetic work; and peer review comments from Brzoska *et al.* (2011)) be included in a re-publication of the proposed rule.

Our Response: In rulemaking decisions under the Act, the Service makes available all cited literature used that is not already publicly available. We post grey literature, information from States, or other unpublished resources on *http://www.regulations.gov* concurrent with the **Federal Register** publication.

(30) *Comment:* One commenter stated that it was inappropriate to make references to the Coral Reef Commons proposed development and habitat conservation plan (HCP) in the proposed rule.

Our Response: Under *Factor A* below we discuss the threat of proposed development in the Richmond Pine Rocklands, but we do not directly use the name ''Coral Reef Commons.'' Information about this proposed development was cited using the publicly available draft HCP. This discussion is appropriate and required under section 4 of the Act (16 U.S.C. 1533), because the proposed development of Coral Reef Commons is within suitable Miami tiger beetle habitat and, therefore, must be included in an analysis of the threatened destruction of habitat.

(31) *Comment:* Two commenters questioned the peer review of documents used in the proposed listing rule, the reliance on the work of Dr. Barry Knisley, and the affiliation between Dr. Knisley and one of the petitioners.

Our Response: Dr. Knisley is regarded as one of the nation's foremost experts on tiger beetles generally (*e.g.,* has (co)authored 58 publications including 3 books on tiger beetles) and the Miami tiger beetle specifically, and he has performed the vast majority of research on the Miami tiger beetle, including extensive surveys under contract with the Service. Thus, the heavy reliance on his work in the listing rule is fully appropriate. Christopher Wirth, one of the petitioners, was a former student and research assistant under Dr. Knisley; however, Dr. Knisley is not included as one of the petitioners. As noted by the commenters, Dr. Knisley has stated that his research focuses on the conservation of rare tiger beetles and unique natural areas. There is no basis or evidence to support the commenters' claims of bias on Dr. Knisley's part.

(32) *Comment:* Two commenters claim that photographs published in Brzoska *et al.* (2011, entire) appear to be digitally enhanced and, if so, must be fully disclosed. One of these commenters also presents pictures of the Miami and scabrous tiger beetles from the Florida State Collection of Arthropods (FSCA) and claims there are no discernible differences other than color.

Our Response: Photographs of specimens in Brzoska *et al.* (2011, entire) were taken by Christopher Wirth. He has informed us that the photographs were not digitally enhanced, and rely only on reflected flash lighting (Wirth, 2016b, pers. comm.). In regard to the photographs taken from the FSCA, it appears that the Miami and scabrous tiger beetles not only differ in coloration, but also the presence of a medial spot and thicker apical lunule (crescent shape) in the scabrous tiger beetle.

Summary of Changes From the Proposed Rule

Based on information we received in peer review and public comments, we made the following changes:

In the Background section:

(1) We included larval microhabitat as an important factor to differentiate species.

(2) We revised the historical range of the Miami tiger beetle as possibly localized considering the lack of collection for nearly 70 years.

(3) We updated literature citations to those most currently available and replaced and removed citations from Duran and Gwiazdowski (in preparation) and Spomer (2014, pers. comm.), respectively.

In the Summary of Factors Affecting the Species section:

(4) We included run-off from potential development as a threat to habitat quality.

(5) We included discussion of the Zika virus under the potential for pesticide exposure.

(6) We included new observations of robber fly species in Miami tiger beetle habitat.

(7) We revised wording related to the location of the two known Miami tiger beetle populations.

(8) We added a citation and text pertaining to the necessity of fire to maintain pine rockland habitat.

(9) We included the State of Florida's biological status review of the Miami tiger beetle.

(10) We included new information on known collection of the Miami tiger beetle.

(11) We included text regarding maintenance of EELs lands within Miami-Dade County.

(12) We made minor editorial changes in verb tense, language clarification, and redundant word usage.

Summary of Factors Affecting the Species

Section 4 of the Act 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).

One of the two known populations of the Miami tiger beetle occurs 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 8,343 people per square mile (*https://www.bebr.ufl.edu/population/publications/measuring-population-density-counties-florida* [accessed May 18, 2016]), and development and human population growth are expected to continue in the future. By 2025, Miami-Dade County is predicted to near or exceed a population size of 3 million people (Rayer and Wang 2016, p. 7). This predicted economic and population growth will further increase demands for land, water, and other resources, which will undoubtedly exacerbate the threats to 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%20Negotiate%20(ITN)* [accessed April 24, 2014]). The proposed development includes the following: Theme park rides; a seasonally opened water park; a 400-room hotel with a Sony Music Theatre performance venue; a 2,900-square meter (30,000-square feet) 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 56 ha (138 ac) (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 13 ha (33 ac) 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 how they will 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 addition to constraints with fire management, run-off from development (*e.g.,* structures, asphalt, concrete) into adjacent pine rockland habitat will likely increase and further alter the habitat quality (Schultz, 2016, pers. comm.).

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 a thick duff layer accumulates and eventually results in the appearance of organic rich humic soils rather than organic poor mineral soils (Alexander 1967, p. 863; Wade *et al.* 1980, p. 92; Loope and Dunevitz 1981, p. 6; Snyder *et al.* 1990, p. 260). Fire is not only a necessity for maintaining pine rockland habitat, but also for preventing catastrophic loss to surrounding property and life in an urban landscape (URS 2007, p. 38). Studies and management plans have emphasized the necessity of prescribed fire in pine rockland habitat and highlighted it as preferential, compared to the alternatives to prescribed fire (*e.g.,* herbicide application and mechanical treatment) (Snyder *et al.* 2005, p. 1; URS 2007, p. 39).

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 (URS, 2007, p. 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 has 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 nontarget 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, 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 contain 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 firebreaks, 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, 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 that occurred in the past, continue currently, and are expected 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). Recently, there was posting on social media from a tiger beetle collector with images of several rare species, including nine specimens of the Miami tiger beetle that are thought to have been collected at Zoo Miami (Wirth, 2016a, pers. comm.). 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 a serious threat to the Miami tiger beetle due to the species' 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 scabrous 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 (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 combination of 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. A few species of robber flies (*Polacantha gracilis, Triorla interrupta, Efferia* sp., and *Diogmites* sp.) have been observed in pine rocklands where the Miami tiger beetle is present (Mays and Cook 2015, p. 5; J. Kardys, 2016, pers. comm.); 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 System or National Park Service land. The Miami tiger beetle is known to occur on USCG lands within the Richmond Pinelands Complex, and there are limited protections 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*), *Brickellia mosieri* (Florida brickell-bush), *Linum carteri* var. *carteri* (Carter's small-flowered flax), *Chamaesyce deltoidea* ssp. *deltoidea* (deltoid spurge), and *Polygala smallii* (tiny polygala). 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 State was also petitioned and has started a biological status review of the species. 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 for, 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 allow 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 (1,550 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) (*http://www.miamidade.gov/environment/endangered-lands.asp#1* [Accessed May 11, 2016]). Unfortunately, many of these pine rocklands are not managed to maintain the open, sparsely vegetated areas that are needed by the beetle.

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 known from only 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 (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 (1982, 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, and this risk may increase with the spread of any mosquito-borne disease, such as the Zika virus, as current guidelines to incorporate no-spray buffers around butterfly critical habitat are not necessarily adhered to if there is a public health concern (Florida Administrative Code 5E–13.036; Service 2015, entire).

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 (*Heraclides 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). 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 2015a, 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 8,343 people per square mile (*https://www.bebr.ufl.edu/population/publications/measuring-population-density-counties-florida* [accessed May 18, 2016]), and development and human population growth are expected to continue in the future. By 2025, Miami-Dade County is predicted to near or exceed a population size of 3 million people (Rayer and Wang 2016, p. 7). 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 the 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; Euskirchen *et al.* 2009; McKechnie and Wolf 2009; Berg *et al.* 2010; 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.

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 (°C) (3.6–9 degrees Fahrenheit (°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, p. 76).

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 0.6 m (2 ft) per century or greater. With a 1.5-m (5-ft) rise (spring tides at ~2.4 m (~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 threatening one of only two known populations 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 two known, small populations of the Miami tiger beetle appear to occupy relatively small habitat patches, which make them 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 are listing the Miami tiger beetle as endangered 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 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. Because we have determined that the Miami tiger beetle is endangered throughout all of its range, no portion of its range can be ''significant'' for purposes of the definitions of ''endangered species'' and ''threatened species.'' See the Final Policy on Interpretation of the Phrase ''Significant Portion of Its Range'' in the Endangered Species Act's Definitions of ''Endangered Species'' and ''Threatened Species'' (79 FR 37577).

Available Conservation Measures

Conservation measures provided to species listed as endangered or threatened species 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 requires that recovery actions be carried out for all 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 requires 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 identifies site-specific management actions that set a trigger for review of the five factors that control whether a species remains endangered or may be downlisted or delisted, 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 Web site (*http://www.fws.gov/endangered*) or from our 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, Tribal, 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 these species requires cooperative conservation efforts on private, State, and Tribal lands.

Following publication of this final listing rule, 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 will 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.*

Please let us know if you are interested in participating in recovery efforts for the Miami tiger beetle. 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 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)(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 any endangered or threatened 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; issuance of section 404 Clean Water Act permits by the 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 endangered wildlife. The prohibitions of section 9(a)(1) of the Act, codified at 50 CFR 17.21, make it illegal for any person subject to the jurisdiction of the United States to take (which includes harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect; or to attempt any of these) endangered wildlife within the United States or on the high seas. In addition, it is unlawful to import; export; deliver, receive, carry, transport, or ship in interstate or foreign commerce in the course of commercial activity; or sell or offer for sale in interstate or foreign commerce any listed species. It is also illegal to possess, sell, deliver, carry, transport, or ship any such wildlife that has been taken illegally. Certain exceptions apply to employees of the Service, the National Marine Fisheries Service, other Federal land management agencies, and State conservation agencies.

We may issue permits to carry out otherwise prohibited activities involving endangered wildlife under certain circumstances. Regulations governing permits are codified at 50 CFR 17.22. With regard to endangered wildlife, a permit may 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.

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 final listing on proposed and ongoing activities within the range of a listed species. Based on the best available information, the following actions 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)) also 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 chapter are no longer necessary.''

In the proposed listing rule (80 FR 79533, December 22, 2015), we determined that designation of critical habitat for the Miami tiger beetle was prudent. See the *Prudency Determination* in the proposed rule for more information.

Once we determine that the designation is prudent, we must find whether critical habitat for *Cicindelidia floridana* is determinable. Our regulations (50 CFR 424.12(a)(2)) 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.

In our proposed listing rule, we found that critical habitat was not determinable because the specific information sufficient to perform the required analysis of the impacts of the designation was lacking. We are still in the process of obtaining that information, but anticipate that a proposed rule designating critical habitat for the Miami tiger beetle will be published before the end of fiscal year 2017.

Required Determinations

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 (NEPA), 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).

Government-to-Government Relationship With Tribes

In accordance with the President's memorandum of April 29, 1994 (Government-to-Government Relations with Native American Tribal Governments; 59 FR 22951), Executive Order 13175 (Consultation and Coordination with Indian Tribal Governments), and the Department of the Interior's manual at 512 DM 2, we readily acknowledge our responsibility to communicate meaningfully with recognized Federal Tribes on a government-to-government basis. In accordance with Secretarial Order 3206 of June 5, 1997 (American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act), we readily acknowledge our responsibilities to work directly with tribes in developing programs for healthy ecosystems, to acknowledge that tribal lands are not subject to the same controls as Federal public lands, to remain sensitive to Indian culture, and to make information available to tribes. We are not aware of any *Cicindelida floridana* populations on tribal lands.

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 Field Office (see **FOR FURTHER INFORMATION CONTACT**).

Authors

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

List of Subjects in 50 CFR Part 17

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

Regulation Promulgation

Accordingly, we amend part 17, subchapter B of chapter I, title 50 of the Code of Federal Regulations, as follows:

PART 17—[AMENDED]

■ 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 the following entry to the List of Endangered and Threatened Wildlife in alphabetical order under Insects:

§ 17.11 Endangered and threatened wildlife.

* * * * *

(h) * * *

Common name	Scientific name	Where listed	Status	Listing citations and applicable rules
* *	* *	*	*	*
INSECTS				
* *	* *	*	*	*
Beetle, Miami tiger	*Cicindelidia floridana*	U.S.A. (FL)	E	81 FR [*Insert **Federal Register** page where the document begins*]; October 5, 2016.
* *	* *	*	*	*

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Dated: September 21, 2016.

Stephen Guertin,

Acting Director, U.S. Fish and Wildlife Service.

[FR Doc. 2016–23945 Filed 10–4–16; 8:45 am]

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