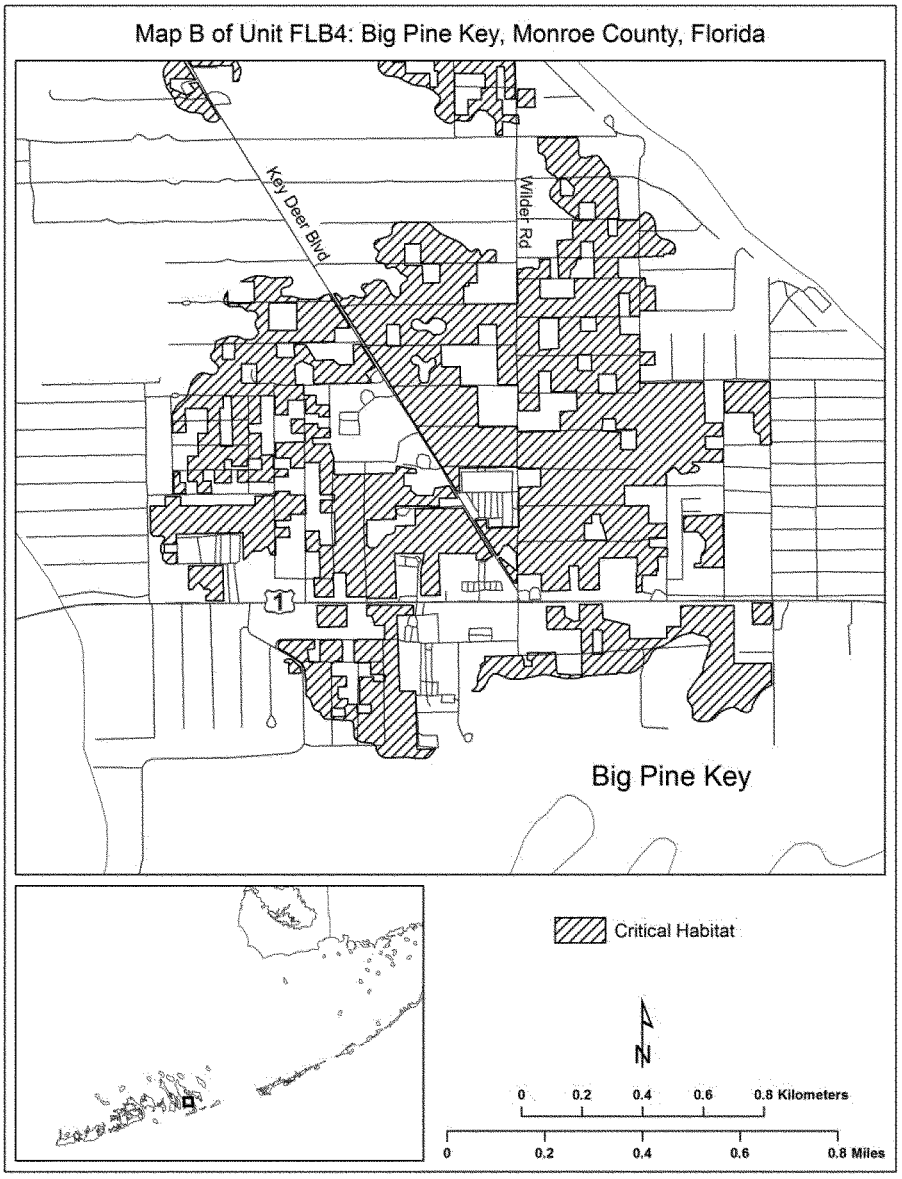

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Dated: August 6, 2013.

Michael Bean,

Acting Principal Deputy Assistant Secretary for Fish and Wildlife and Parks.

[FR Doc. 2013–19793 Filed 8–14–13; 8:45 am]

BILLING CODE 4310–55–C

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS–R4–ES–2013–0084;

RIN 1018–AZ08

Endangered and Threatened Wildlife and Plants; Endangered Status for the Florida Leafwing and Bartram's Scrub-Hairstreak Butterflies

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Proposed rule.

SUMMARY: We, the U.S. Fish and Wildlife Service (USFWS), propose to list the Florida leafwing (*Anaea troglodyta floridalis*) and Bartram's scrub-hairstreak (*Strymon acis bartrami*) butterflies as endangered species under the Endangered Species Act. If we finalize this rule as proposed, it would extend the Act's protections to these species. The effect of these regulations is to conserve the Florida leafwing and Bartram's scrub-hairstreak under the Act.

DATES: We will accept comments received or postmarked on or before October 15, 2013. Comments submitted electronically using the Federal eRulemaking Portal (see **ADDRESSES** section, below) must be received by 11:59 p.m. Eastern Time on the closing date. We must receive requests for public hearings, in writing, at the address shown in **FOR FURTHER INFORMATION CONTACT** by September 30, 2013.

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

(1) *Electronically:* Go to the Federal eRulemaking Portal: *http://www.regulations.gov.* In the search box, enter FWS–R4–ES–2013–0084, which is the docket number for this rulemaking. You may submit a comment by clicking on ''Comment Now''.

(2) *By hard copy:* Submit by U.S. mail or hand-delivery to: Public Comments Processing, Attn: FWS–R4–ES–2013–0084; Division of Policy and Directives Management; U.S. Fish and Wildlife Service; 4401 N. Fairfax Drive, MS 2042–PDM; Arlington, VA 22203.

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

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

SUPPLEMENTARY INFORMATION:

Executive Summary

Why we need to publish a rule. Under the Act, if a species is determined to be an endangered or threatened species throughout all or a significant portion of its range, we are required to promptly publish a proposal in the **Federal Register** and make a determination on our proposal within 1 year. Critical habitat shall be designated, to the maximum extent prudent and determinable, for any species determined to be an endangered or threatened species under the Act. Listing a species as an endangered or threatened species and designations of critical habitat can be completed only by issuing a rule. Elsewhere in today's **Federal Register**, we propose to designate critical habitat for the Florida leafwing butterfly and Bartram's scrub hairstreak butterfly under the Act.

This rule consists of: A proposed rule to list the Florida leafwing butterfly (*Anaea troglodyta floridalis*) and the Bartram's scrub-hairstreak butterfly (*Strymon acis bartrami*) as endangered species. Both butterflies are candidate species for which we have on file sufficient information on biological vulnerability and threats to support preparation of a listing proposal, but for which development of a listing regulation has until now been precluded by other higher priority listing activities. This rule reassesses all available information regarding status of and threats to both butterfly subspecies.

The basis for our action. Under the Act, we can 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 the threats to both subspecies fall under all five factors, and consist of a lack of adequate fire management, small population size, isolation from habitat loss and fragmentation, loss of genetic diversity, inadequate regulatory mechanisms, pesticide applications, poaching, hurricanes and storm surge, and sea level rise.

We will seek peer review. We are seeking comments from knowledgeable individuals with scientific expertise to review our analysis of the best available science and application of that science and to provide any additional scientific information to improve this proposed rule. Because we will consider all comments and information received during the comment period, our final determinations may differ from this proposal.

Information Requested

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

(1) Both species' biology, range, and population trends, including:

(a) Habitat requirements for feeding, breeding, and sheltering;

(b) Genetics and taxonomy;

(c) Historical and current range including distribution patterns;

(d) Historical and current population levels, and current and projected trends; and

(e) Past and ongoing conservation measures for the species, their habitat, or both.

(2) The factors that are the basis for making a listing determination for a species under section 4(a) of the Act, which are:

(a) The present or threatened destruction, modification, or curtailment of their 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 their continued existence.

(3) Biological, commercial trade, or other relevant data concerning any threats (or lack thereof) to these species and regulations that may be addressing those threats; including the use and effects of pesticides to control mosquitos and other insects considered pests.

(4) The use of prescribed fire or other management tools to simulate historical natural disturbances to restore or maintain the species habitat.

(5) Additional information concerning the historical and current status, range, distribution, and population size of these species, including the locations of any additional populations of these species.

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

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

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

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

comments to allow us to verify any scientific or commercial information you include.

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

Previous Federal Actions

The Florida leafwing and Bartram's scrub-hairstreak (previously known as the Bartram's hairstreak) butterflies have the same history of being candidates for listing under the Act. Both butterflies were first recognized as candidates on May 22, 1984 (49 FR 21664). We assigned both species a listing priority number (LPN) of 2. Candidate species are assigned LPNs based on immediacy and magnitude of threats, as well as taxonomic status. The lower the LPN, the higher priority that species is for us to determine appropriate action using our available resources (September 21, 1983; 48 FR 43100). Category 2 species were defined as species for which we had information that proposed listing was possibly appropriate, but conclusive data on biological vulnerability and threats were not available to support a proposed rule at the time. Both species remained on the candidate list, as published in what is now known as the Candidate Notice of Review (CNOR), as category 2 species until 1994 (January 6, 1989, 54 FR 572; November 21, 1991, 56 FR 58830). Both species were removed from the candidate list from 1996 to 2005 because we did not have sufficient information on the species' biological vulnerability and threats to support issuance of a proposed rule. Both species were added to the candidate list in the 2006 CNOR and assigned an LPN of 3 (September 12, 2006, 71 FR 53760). An LPN of 3 meant that the magnitude of threats remained high and immediate with recognition of their taxonomic status as subspecies. Both species remained on the candidate list as published in the CNORs from 2007 to 2012 with the LPN of 3 (72 FR 69034, December 6, 2007; 73 FR 75176, December 10, 2008; 74 FR 578040, November 9, 2009; 75 FR 69222, November 10, 2010; 76 FR 66370, October 26, 2011; and November 21, 2012, 77 FR 69994).

On May 10, 2011, the Service announced a work plan to restore biological priorities and certainty to the Service's listing process. As part of an agreement with one of the agency's most frequent plaintiffs, the Service filed a work plan with the U.S. District Court for the District of Columbia. The work plan will enable the agency to, over a period of 6 years, systematically review and address the needs of more than 250 species listed within the 2010 Candidate Notice of Review, including the Florida leafwing and Bartram's scrub-hairstreak, to determine if these species should be added to the Federal Lists of Endangered and Threatened Wildlife and Plants. This work plan will enable the Service to again prioritize its workload based on the needs of candidate species, while also providing State wildlife agencies, stakeholders, and other partners clarity and certainty about when listing determinations will be made. On July 12, 2011, the Service reached an agreement with a frequent plaintiff group and further strengthened the workplan, which will allow the agency to focus its resources on the species most in need of protection under the Act. These agreements were approved on September 9, 2011. The timing of this proposed listing is, in part, therefore, an outcome of the workplan.

The Service's decision to propose listing of the Florida leafwing and Bartram's scrub-hairstreak resulted from our careful review of the status of these butterflies and assessments of their threats.

Elsewhere in today's **Federal Register**, we propose to designate critical habitat for the Florida leafwing and Bartram's scrub-hairstreak butterflies under the Act.

Status Assessment for the Florida Leafwing and Bartram's Scrub-Hairstreak Butterflies

Florida Leafwing

General Biology

The Florida leafwing butterfly is a medium-sized butterfly approximately 76 to 78 millimeters (mm) (2.75 to 3.00 inches (in)) in length with a forewing length of 34 to 38 mm (1.3 to 1.5 in) and an appearance characteristic of its genus (Comstock 1961, p. 44; Pyle 1981, p. 651; Opler and Krizek 1984, p. 172; Minno and Emmel 1993, p. 153). The upper-wing (or open wing) surface color is red to red-brown. The underside (closed wings) is gray to tan, with a tapered outline, cryptically looking like a dead leaf or the bark of slash pine trees (*Pinus elliottii* var. *densa*) when the butterfly is at rest. The Florida leafwing exhibits sexual dimorphism (male and female are different from each other), with females being slightly larger and with darker coloring along the wing margins than the males. The butterfly also has seasonal forms (Comstock 1961, pp. 44–45; Salvato and Hennessey 2003, p. 244). Comstock (1961, pp. 44–45) employed the terms ''summer'' and ''winter'' morph to differentiate between seasonal forms within the genus. The length of photoperiod exposure experienced by fifth-instar larvae (larvae several days prior to pupation), as well as the influence of seasonal moisture, have been identified as key factors in determining the seasonal forms within members of the *Anaea* genus of leafwing butterflies (Riley 1980, p. 333; 1988a, p. 266; 1988b, p. 226; Salvato and Hennessey 2003, p. 246). The summer form (wet-season or long-day form), occurring in late May to September, tends to have forewing margins that are blunt and hind-wings with a less pronounced tail; colors also tend to be brighter. The winter form (dry-season or short-day form), occurring in October to early May, tends to have the opposing characters, with pronounced tails and crescent-shaped forewings (Comstock 1961, pp. 44–45; Salvato 1999, p. 118; Salvato and Hennessey 2003, p. 246).

The Florida leafwing has only one known hostplant, the pineland croton (*Croton linearis*) (Euphorbiaceae). The immature stages of this butterfly feed on pineland croton for development. As in the adult butterfly stage, the larval development of the leafwing also displays a cryptic mimicry of the host plant. The first three instars (developmental life stages) of a five instar larval development begin what continues throughout larval development to be a cryptic mimicry of the hostplant. These stages appear like dead leaves, with a brown color and resting on a dead part of the plant during the day (Salvato 1999, p. 118; 2003, p. 244). Early instars tend to eat the leaves to the mid-vein and then dangle from them in camouflage. They dangle by creating a frass chain (strings composed of silk and feces) for protection from predators (Salvato and Salvato 2008, p. 327). Briefly, a frass chain is created when the larvae attach their fecal pellets to the mid-vein of a partially eaten croton leaf with silk (Minno *et al.* 2005, p. 115). The larvae crawl to the terminus of the strands to avoid predation. The two later instars are light green in color, with a tapering body from the cephalad (head capsule) to the caudal end (posterior), so that, when at rest, it also appears like a croton leaf in the spiral fashion of the terminal end of the leaf (Worth *et al.* 1996, p. 64). The head capsule during all stages bears many tiny setae (bristles), presenting the granular

appearance of croton seeds (Worth *et al.* 1996, p. 64).

Taxonomy

The Florida leafwing butterfly (*Anaea troglodyta floridalis*) was first described by Johnson and Comstock in 1941. *Anaea troglodyta floridalis* is a taxon considered to be both endemic to south Florida and clearly derived from Antillean stock (the islands of the West Indies except for the Bahamas, separating the Caribbean Sea from the Atlantic Ocean) (Comstock 1961, p. 45; Brown and Heineman 1972, p. 124; Minno and Emmel 1993, p. 153; Smith *et al.* 1994, p. 67; Salvato 1999, p. 117; Hernandez 2004, p. 39; Pelham 2008, p. 393). Some authors (Comstock 1961, p. 44; Miller and Brown 1981, p. 164; Smith *et al.* 1994, p. 67; Hernandez 2004, p. 39) placed the Florida leafwing as a distinct species, *A. floridalis.* Others (Brown and Heineman 1972, p. 124; Minno and Emmel 1993, p. 153; Salvato 1999, p. 117; Opler and Warren 2003, p. 40) considered the Florida leafwing as a subspecies of *Anaea troglodyta* Fabricius. Smith *et al.* (1994, p. 67) suggested that further comparison between immature stages of the Florida leafwing and its Antillean relatives may aid in determining whether or not the Florida leafwing is distinct at the species or subspecies level. Opler and Warren (2003, p. 40) and Pelham (2008, p. 393) considered *Anaea troglodyta floridalis,* not *A. floridalis,* as the scientific name for the Florida leafwing.

The Integrated Taxonomic Information System (ITIS) (2013, p. 1) uses the name *Anaea troglodyta floridalis* (F. Johnson and W. Comstock, 1941) and indicates that this subspecies' taxonomic standing is valid. The Florida Natural Areas Inventory (FNAI) (2012, p. 19) uses the name *A. t. floridalis.*

Life History

Numerous authors have observed and documented the behavior and natural history of the Florida leafwing (Lenczewski 1980, p. 17; Pyle 1981, p. 651; Baggett 1982, pp. 78–79; Opler and Krizek 1984, p. 172; Schwartz 1987, p. 22; Hennessey and Habeck 1991, pp. 13–17; Smith *et al.* 1994, p. 67; Worth *et al.* 1996, pp. 4–6; Salvato 1999, pp. 116–122; Salvato and Hennessey 2003, pp. 243–249; Salvato and Salvato 2008, pp. 323–329; 2010a, pp. 91–97). Adults are rapid, wary fliers and have strong flight abilities and are able to disperse over large areas. The butterfly is extremely territorial, with both sexes flying out to pursue other leafwings, as well as other butterfly species (Baggett 1982, p. 78; Worth *et al.* 1996, p. 65; Salvato and Hennessey 2003, p. 246; Salvato and Salvato 2010a, p. 96). Minno (pers. comm. 2009) and Salvato and Salvato (2010a, p. 96) noted that males are generally more territorial. The Florida leafwing is multivoltine (*i.e.,* produces multiple generations per year), with an entire life cycle of about 2 to 3 months (Hennessey and Habeck 1991, p. 17) and maintains continuous broods throughout the year (Salvato 1999, p. 121). The precise number of broods per year remains unknown, but the leafwing has been recorded in every month (Baggett 1982, p. 78; Opler and Krizek 1984, p. 172; Minno and Emmel 1993, p. 153; Salvato and Hennessey 2003, p. 247; Salvato and Salvato 2010a, p. 96; 2010c, p. 140). Salvato and Salvato (2010a, p. 93) and Land (Everglades National Park (ENP), pers. comm. 2012b) encountered the butterfly throughout the year, but the majority of observations occurred from late fall to spring in ENP. By contrast, Salvato and Salvato (2010c, p. 139) reported finding the butterfly on Big Pine Key, abundantly throughout the year, particularly during the summer months.

Eggs are spherical and light cream-yellow in color (Worth *et al.* 1996, p. 64). Females lay eggs singly on both the upper and lower surface of the host (croton plant) leaves, normally on developing racemes (flowers) (Baggett 1982, p. 78; Hennessey and Habeck 1991, p. 16; Worth *et al.* 1996, p. 64; Salvato 1999, p. 120). Worth *et al.* (1996, p. 64) and Salvato (1999, p. 120) visually estimated that females may fly more than 30 meters (m) (98 feet (ft)) in search of a suitable host plant and usually require less than a minute to oviposit (lay) each egg.

Adult Florida leafwings will feed on tree sap, take minerals from mud, and occasionally visit flowers. Adults have also been observed feeding on rotting fruit and dung (Baggett 1982, p. 78; Opler and Krizek 1984, p. 172; Minno and Emmel 1993, p. 153), senescent (older) flowers of saw palmetto (*Serenoa repens*) (Hennessey and Habeck 1991, p. 13), a sliced orange (Salvato 1999, p. 121), sap of willow bustic (*Sideroxylon salicifolium*) excreted from feeding holes created by yellow-bellied sapsuckers (*Sphyrapicus varius*) (Salvato and Salvato 2008, p. 326), and sap from slash pines and wild tamarind (*Lysiloma latisiliquum*) (Salvato and Salvato 2008, p. 326; Salvato and Salvato 2010a, p. 96). Adults are not frequently attracted to flowers (Baggett 1982, p. 78; Opler and Krizek 1984, p. 172; Worth *et al.* 1996, p. 65). However, Salvato and Salvato (2010a, p. 96) observed freshly emerged adults taking nectar from a variety of plants, including Spanish needles (*Bidens alba*), shrub verbena (*Lantana camara*), and false mallow (*Malvastrum corchorifolium*) within a weedy, disturbed area on the extreme southern border of Long Pine Key in ENP. Lenczewski (1980, p. 17) observed adults at the edges of mud puddles. Salvato and Hennessey (2003, p. 248) also observed this puddling behavior by adult male Florida leafwings on Big Pine Key and in ENP.

Bartram's Scrub-Hairstreak

General Biology

The Bartram's scrub-hairstreak is a small butterfly approximately 25 mm (1 in) in length with a forewing length of 10.0 to 12.5 mm (0.4 to 0.5 in) and has an appearance (*i.e.,* dark gray-colored on the upper (open) wings, light gray-colored under (closed) wings, small size, body shape, distinctive white barring or dots on underwings, and tailed hindwings) characteristic of the genus (Pyle 1981, p. 480; Opler and Krizek 1984, pp. 107–108; Minno and Emmel 1993, p. 129). As with the Florida leafwing, pineland croton is the only known hostplant for the Bartram's scrub-hairstreak (Minno and Emmel 1993, p. 129; Smith *et al.* 1994, p. 118). The Bartram's scrub-hairstreak does not exhibit sexual or seasonal dimorphism, but does show some sexual differences in coloration. The abdomen of the male is bright white, while females are gray (Minno and Emmel 1993, p. 129; Minno and Minno 2009, p. 70).

Eggs are laid singly on the flowering racemes of pineland croton (Worth *et al.,* 1996, p. 62; Salvato and Hennessey 2004, p. 225). The immature stages of this butterfly feed on pineland croton for development. First and second instars remain well camouflaged amongst the white croton flowers, while the greenish later stages occur more on the leaves. Salvato and Hennessey (2004, p. 225) reported approximate body lengths of 2, 4, 6, and 11 mm (0.8, 0.16, 0.24, and 0.43 in) for Bartram's scrub-hairstreak for the second through fifth instar larvae, respectively.

Taxonomy

The Bartram's scrub-hairstreak butterfly (*Strymon acis bartrami*) was first described by Comstock and Huntington in 1943. Seven subspecies of *Strymon acis* have been described (Smith *et al.* 1994, p. 118). Smith *et al.* (1994, p. 118) indicated that perhaps no other butterfly in the West Indies has evolved as many distinct island subspecies as *S. acis.* Each group of Antillean islands appears to have its own particular set of *S. acis* hairstreaks, and these have been classified into two

separate groups. The Type A subspecies are larger, darker colored and are found in the more southeastern Antillean islands. The Type B subspecies, to which the Bartram's scrub-hairstreak belongs, are smaller, more surface-grey colored.

The ITIS (2013, p. 1) uses the name *Strymon acis bartrami* and indicates that this subspecies' taxonomic standing is valid. FNAI (2012, p. 21) uses the name *S. a. bartrami.*

Life History

The Bartram's scrub-hairstreak is a sedentary butterfly rarely encountered more than 5 m (16.4 ft) from its host plant (Schwartz 1987, p. 16; Worth *et al.* 1996, p. 65; Salvato and Salvato 2008, p. 324). Females oviposit on the flowering racemes of pineland croton (Worth *et al.* 1996, p. 62; Salvato and Hennessey 2004, p. 225). Eggs are laid singly on the developing flowers. Hennessey and Habeck (1991, p. 18) observed a female oviposit three eggs over the course of 5 minutes. This long duration of oviposition likely enables females to serve as one of the major pollinating species for the host plant (Salvato 2003, p. 57).

The Bartram's scrub-hairstreak is most often observed visiting pineland croton flowers for nectar, but has also been observed using the flowers of other species, including: Pine acacia (*Acacia pinetorum*), Spanish needles, saw palmetto (*Serenoa repens*), button sage (*Lantana involucrata*), Bloggett's swallowwort (*Cynanchum blodgettii*), Everglades Key false buttonwood (*Spermacoce terminalis*), locustberry (*Byrsonima lucida*), and starrush whitetop (*Rhynchospora colorata*) (Minno and Emmel 1993, p. 129; Worth *et al.* 1996, p. 65; Calhoun *et al.* 2002, p. 14; Salvato and Hennessey 2004, p. 226; Salvato and Salvato 2008, p. 324; C. Anderson, pers. comm. 2010).

The Bartram's scrub-hairstreak has been observed during every month on Big Pine Key and ENP; however, the exact number of broods appears to vary sporadically from year to year (Salvato and Hennessey 2004, p. 226; Salvato and Salvato 2010b, p. 156). Baggett (1982, p. 81) indicated that the Bartram's scrub-hairstreak seemed most abundant October–December. Salvato and Salvato (2010b, p. 156) encountered the butterfly most often during March through June within ENP. Land (pers. comm. 2012b) has noted the butterfly to be most abundant in the spring and summer months. One of the earliest reports of *S. a. bartrami* phenology from Big Pine Key was provided by Schwartz (1987, p. 16) who encountered the butterfly only during April, November, and December, despite an extensive annual survey. Subsequent research by Hennessey and Habeck (1991, pp. 17–19), Emmel *et al.* (1995, pp. 14–15), and Minno and Minno (2009, pp. 70–76) reported occurrences of Bartram's scrub-hairstreak on Big Pine Key throughout the year with varying peaks in seasonal abundance. Salvato and Salvato (unpublished data) have reported finding the butterfly abundant throughout the year on Big Pine Key, particularly during the late spring. Salvato (1999, p. 47) suggests the butterfly can occur in high numbers during any season if suitable habitat and conditions are present. Service Biologist Chad Anderson (pers. comm. 2012a) has found them most active when the average temperature is consistently near 27 degrees Celsius (°C) (80 degrees Fahrenheit (°F)), which can occur at any time of year. In addition, reference plots and random survey transects on Big Pine Key have consistently indicated that peak relative abundances can differ among subpopulations within the same year (Anderson, pers. comm. 2012b).

Florida Leafwing and Bartram's Scrub-Hairstreak

Habitat

The Florida leafwing and Bartram's scrub-hairstreak occur only within pine rocklands, specifically those that retain their mutual and sole hostplant, pineland croton. Adult butterflies will also make use of rockland hammock vegetation when interspersed within the pine rockland habitat.

Pine Rockland

Pine rockland is characterized by an open canopy of South Florida slash pine (*Pinus elliottii* var. *densa*) with a patchy understory of tropical and temperate shrubs and palms and a rich herbaceous layer of mostly perennial species including numerous species endemic to South Florida. Outcrops of weathered oolitic (small rounded particles or grains) limestone, known locally as pinnacle rock, are common, and solution holes may be present. This subtropical, pyrogenic flatland can be mesic or xeric depending on landscape position and associated natural communities. There are differences in species composition between the pine rocklands found in the Florida Keys and the mainland (FNAI 2010a, p. 1).

Pine rockland has an open canopy of South Florida slash pine, generally with multiple age classes. The diverse, open shrub and subcanopy layer is composed of more than 100 species of palms and hardwoods (FNAI 2010a, p. 1), most derived from the tropical flora of the West Indies (FNAI 2010a, p. 1). Many of these species vary in height depending on fire frequency, getting taller with time since fire. These include saw palmetto (*Serenoa repens*), cabbage palm (*Sabal palmetto*), silver palm (*Coccothrinax argentata*), brittle thatch palm (*Thrinax morrisii*), wax myrtle (*Myrica cerifera*), myrsine (*Rapanea punctata*), poisonwood (*Metopium toxiferum*), locustberry (*Byrsonima lucida*), varnishleaf (*Dodonaea viscosa*), tetrazygia (*Tetrazygia bicolor*), rough velvetseed (*Guettarda scabra*), marlberry (*Ardisia escallonioides*), mangrove berry (*Psidium longipes*), willow bustic (*Sideroxylon salicifolium*), winged sumac (*Rhus copallinum*). Short-statured shrubs include running oak (*Quercus elliottii*), white indigoberry (*Randia aculeata*), Christmas berry (*Crossopetalum ilicifolium*), redgal (*Morinda royoc*), and snowberry (*Chiococca alba*).

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

Pine rockland occurs on relatively flat, moderately to well drained terrain from 2 to 7 m (6.5 to 23 ft) above sea level (FNAI 2010a, p. 2). The oolitic limestone is at or very near the surface, and there is very little soil development. Soils are generally composed of small accumulations of nutrient-poor sand, marl, clayey loam, and organic debris in depressions and crevices in the rock surface. Organic acids occasionally dissolve the surface limestone causing collapsed depressions in the surface rock called solution holes (FNAI 2010a, p. 1). Drainage varies according to the porosity of the limestone substrate, but is generally rapid. Consequently, most sites are wet for only short periods following heavy rains. During the rainy season, however, some sites may be

shallowly inundated by slow-flowing surface water for up to 60 days each year (FNAI 2010a, p. 1).

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

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

Rockland hammock

Rockland hammock is a species-rich tropical hardwood forest on upland sites in areas where limestone is very near the surface and often exposed. The forest floor is largely covered by leaf litter with varying amounts of exposed limestone and has few herbaceous species. Rockland hammocks typically have larger, more mature trees in the interior, while the margins can be almost impenetrable in places with dense growth of smaller shrubs, trees, and vines. Typical canopy and subcanopy species include, *Bursera simaruba, Lysiloma latisiliquum* (false tamarind), *Coccoloba diversifolia* (pigeon plum), *Sideroxylon foetidissimum* (false mastic), *Ficus aurea* (strangler fig), *Piscidia piscipula* (Jamaican dogwood), *Ocotea coriacea* (lancewood), *Drypetes diversifolia, Simarouba glauca* (paradisetree), *Sideroxylon salicifolium* (willow bustic), *Krugiodendron ferreum* (black ironwood), *Exothea paniculata* (inkwood), *Metopium toxiferum,* and *Swietenia mahagoni* (West Indies mahogany).

Mature hammocks can be open beneath a tall well-defined canopy and subcanopy. More commonly, in less mature or disturbed hammocks, dense woody vegetation of varying heights from canopy to short shrubs is often present. Species that generally make up the shrub layers within rockland hammock include several species of *Eugenia* (stoppers), *Thrinax morrisii* and *T. radiata* (thatch palms), *Amyris elemifera* (sea torchwood), *Ardisia escallonioides* (marlberry), *Psychotria nervosa* (wild coffee), *Chrysophyllum oliviforme* (satinleaf), *Sabal palmetto, Guaiacum sanctum* (lignum-vitae), *Ximenia americana* (hog plum), *Colubrina elliptica* (soldierwood), *Pithecellobium unguis-cati* and *Pithecellobium keyense, Coccoloba uvifera,* and *Colubrina arborescens* (greenheart). Vines can be common and include *Toxicodendron radicans* (eastern poison ivy), *Smilax auriculata* (earleaf greenbrier), *Smilax havanensis* (Everglades greenbrier), *Parthenocissus quinquefolia* (Virginia creeper), *Hippocratea volubilis* (medicine vine), and *Morinda royoc* (redgal). The typically sparse short shrub layer may include *Zamia pumila* (coontie), and *Acanthocereus tetragonus* (dildoe cactus). Herbaceous species are occasionally present and generally sparse in coverage. Characteristic species include *Lasiacis divaricata* (smallcane), *Oplismenus hirtellus* (woodsgrass) and many species of ferns (FNAI 2010b, p. 1).

Rockland hammock occurs on a thin layer of highly organic soil covering limestone on high ground that does not regularly flood, but it is often dependent upon a high water table to keep humidity levels high. Rockland hammocks are frequently located near wetlands; in the Everglades they can occur on organic matter that accumulates on top of the underlying limestone; in the Florida Keys they occur inland from tidal flats (FNAI 2010b, p. 1).

Rockland hammock is susceptible to fire, frost, canopy disruption, and ground water reduction. Rockland hammock can be the advanced successional stage of pine rockland, especially in cases where rockland hammock is adjacent to pine rockland. In such cases, when fire is excluded from pine rockland for 15 to 25 years it can succeed to rockland hammock vegetation. Historically, rockland hammocks in South Florida evolved with fire in the landscape, fire most often extinguished near the edges when it encountered the hammock's moist microclimate and litter layer. However, rockland hammocks are susceptible to damage from fire during extreme drought or when the water table is lowered. In these cases fire can cause tree mortality and consume the organic soil layer (FNAI 2010b, p. 2).

The lifecycle of both butterflies occur in the pine rocklands, and in some instances associated rockland hammock vegetation interspersed within this habitat. Adult leafwings prefer the transitional zones between pineland and hammock and will disperse and roost within the pine rockland canopy and associated rockland hammock vegetation (Minno, pers. comm. 2009; Salvato and Salvato 2008, p. 246; 2010a, p. 96). The leafwing, with its strong flight abilities, can disperse to make use of available habitat throughout pine rockland and associated rockland hammock habitat in ENP. Leafwing dispersed similarly into these habitats on Big Pine Key until it was extirpated. The hairstreak prefers more open pine rocklands and is more sedentary than the leafwing with adults rarely encountered more than 5 m (16 ft) from the hostplant.

Historical Ranges

The Florida leafwing and Bartram's scrub-hairstreak are endemic to south Florida including the lower Florida Keys. The butterflies were locally common within pine rockland habitat that once occurred within Miami-Dade and Monroe Counties and were less common and sporadic within croton-bearing pinelands in Collier, Martin (leafwing only), Palm Beach, and Broward Counties (Comstock and Huntington 1943, p. 65; Kimball 1965, pp. 45–46; Baggett 1982, p. 78; Smith *et al.* 1994, p. 67; Salvato 1999, p. 117; Salvato and Hennessey 2003, p. 243; 2004, p. 223).

There is little evidence that these butterflies ventured further north than southern Miami-Dade County to make use of localized, relict populations of hostplants that still persist as far north as Martin County (Salvato 1999, p. 117; Salvato and Hennessey 2003, p. 243; 2004, p. 223). Although these butterflies were widely reported from several locations in southern Miami until the mid-20th century (Smith *et al.* 1994, pp. 67; 118), Salvato (1999, p. 117) found few documented field sighting records or museum collection specimens from areas north of Monroe and Miami-Dade Counties, suggesting that they may not have been common further north historically (Salvato and Hennessey 2003, p. 243; 2004, p. 223).

Current Ranges

Populations of Florida leafwing and Bartram's scrub-hairstreak have become increasingly localized as pine rockland habitat has been lost or altered through anthropogenic activity (Lenczewski 1980, p. 43; Baggett 1982, p. 78; Hennessey and Habeck 1991, p. 4; Schwarz *et al.* 1996, p. 59; Salvato and Hennessey 2003, p. 243; Salvato and

Hennessey 2004, p. 223; Salvato and Salvato 2010a, p. 91; 2010b, p. 154). Long Pine Key in ENP retains the largest undisturbed tracts of pine rockland habitat totaling an estimated 2,313 hectares (ha) (5,716 acres (ac)) on the mainland (Salvato 1999, p. 3; Service 1999, p. 173; Salvato and Hennessey 2004, p. 223). Hennessey and Habeck (1991, p. 4) and Salvato (1999, p. 3) estimated that approximately 1,068 ha (2,638 ac) of appropriate croton-bearing pine rockland habitat occur within Long Pine Key. More recently, ENP fire effects staff have been systematically mapping current pineland croton abundance, distribution, and health throughout Long Pine Key (Land, pers. comm. 2012a; Sadle, pers. comm. 2013c). As of early 2013, approximately 12.5 kilometers (km) (7.7 miles (mi)) of pine rocklands have been evaluated and the hostplant has been documented consistently throughout Long Pine Key.

In Miami-Dade County, outside of ENP, approximately 375 pine rockland habitat fragments remain totaling approximately 1,780 ha (4,398 ac) in 1999 (Service 1999, p. 173). Several of these fragments, particularly those adjacent to ENP, such as Navy Wells and Richmond Pine Rocklands (a mixture of publically and privately owned lands), maintain localized populations of pineland croton as well as small or sporadic occurrences of Bartram's scrub-hairstreak (Salvato 1999, p. 123; Salvato and Hennessey 2004, p. 223; Salvato and Salvato 2010b, p. 154). However, Salvato and Hennessey (2003, p. 243) and Salvato (pers. comm. 2008) have generally failed to observe the Florida leafwing in these or other relict (surviving remnant) pine rockland areas outside ENP. During June 2007, one adult leafwing was observed within Navy Wells (Salvato, pers. comm. 2008); however, no evidence of larval activity was encountered suggesting this observation was a stray occurrence. In addition, no leafwing have been recorded outside of ENP since that time.

Breeding Florida leafwing populations have not been documented in pine rockland fragments adjacent to ENP for the past 25 years. The smallest of the former breeding populations was Navy Wells Pineland Preserve (Navy Wells) (owned and managed by Miami-Dade County), which is approximately 120 ha (296 ac) in size. The hairstreak retains breeding populations on Big Pine Key, on Long Pine Key in ENP, and within a number of pine rockland fragments adjacent to ENP, the smallest of which is approximately 7 ha (18 ac) in size. It is possible that leafwings require relatively larger patches of croton-bearing pine rockland habitat to persist than do hairstreaks. Although larger patches of habitat may be more suitable for these butterflies, the relationship between habitat patch size and suitability is not completely understood.

A geographic information system (GIS) analysis conducted by the Service using data collected by The Institute for Regional Conservation (IRC) in 2004 indicates that 65 pine rockland fragments (of various sizes but at least 1 hectare) containing pineland croton remain in private ownership in Miami-Dade County totaling approximately 190 ha (470 ac) (IRC 2006, page numbers not applicable). Another 12 fragments totaling 180 ha (446 ac) contain the croton and are in public ownership (IRC 2006, page numbers not applicable). In 2012, the Service funded Fairchild Tropical Botanic Gardens (FTBG) to conduct extensive surveys of Miami-Dade pine rockland fragments in order to determine current pineland croton abundance and distribution. Initial results from these surveys are expected in 2013.

In the lower Florida Keys, Big Pine Key retains the largest undisturbed tracts of pine rockland habitat totaling an estimated 560 ha (1,382 ac) (Zhang *et al.* 2010, p. 15; Roberts, pers. comm. 2012). At present, within the Florida Keys pineland croton is known to occur only on Big Pine Key. The last reports of the hostplant from other keys were from those adjacent to Big Pine Key on No Name Key in 1992 (Carlson *et al.* 1993, p. 923) and Little Pine Key in 1988 (Hennessey and Habeck 1991, p. 4). Recent surveys of relict pineland throughout the lower Florida Keys by Hennessey and Habeck (1991, p. 4), Emmel *et al.* (2005, p. 6), and Salvato (1999, p. 28; pers. comm. 2008) failed to locate the plant from any island other than Big Pine Key. The staff at National Key Deer Refuge (NKDR) estimated that approximately 243 ha (600 ac) of croton-bearing pineland exist on public lands on Big Pine Key (C. Anderson, pers. comm. 2012a). However, surveys indicate that only about 13 ha (32 ac) are regularly occupied by Bartram's scrub-hairstreak (C. Anderson, pers. comm. 2013). In addition, many of the plants in these areas show signs of senescence (growing older) (C. Anderson, pers. comm. 2013). Although the Bartram's scrub-hairstreak is extant on Big Pine Key, the Florida leafwing has not been seen on the island since 2006 (Minno and Minno 2009, pp. v, 9; Salvato and Salvato 2010c, p. 139).

Population Estimates and Status

Florida Leafwing

Based on results of all historical (Baggett 1982, p. 78; Schwartz 1987, p. 22; Hennessey and Habeck 1991, p. 17; Worth *et al.* 1996, p. 62; Schwarz *et al.* 1996, p. 59) and recent surveys and natural history studies (Salvato 1999, p. 1; 2001, p. 8; 2003, p. 53; Salvato and Hennessey 2003, p. 243; Salvato and Salvato 2010a, p. 91), the Florida leafwing is extant in ENP and, until recently, had occurred on Big Pine Key and historically in pineland fragments in mainland Miami-Dade County (Smith *et al.* 1994, p. 67; Salvato and Salvato 2010a, p. 91; 2010c, p. 139). Schwartz (1987, pp. 1–19), Hennessey and Habeck (1991, pp. 1–75), Emmel *et al.* (1995, pp. 5–7), and Salvato (1999, pp. 1–168) searched the lower Florida Keys extensively for the Florida leafwing, only encountering the butterfly on Big Pine Key. The butterfly's only remaining metapopulation (a series of small populations that have some level of interactions) at Long Pine Key within ENP has been well documented, (Hennessey and Habeck 1991, pp. 1–75; Smith *et al.* 1994, p. 67; Emmel *et al.* 1995, pp. 5–7; Salvato and Salvato 2010a, pp. 91–97). Results from all known historical surveys are provided in table 1. More recent studies are discussed below.

TABLE 1—SUMMARY OF HISTORIC FLORIDA LEAFWING SURVEYS

Population	Ownership	Years	Size or density numbers of adult butterflies	Source
National Key Deer Refuge—Big Pine Key	Federal—USFWS	1985–1986	34 observed or collected.	Schwartz (1987, p. 25).
National Key Deer Refuge—Watson Hammock.	Federal—USFWS	1988–1989	3.7 per ha (1.5 per acre).	Hennessey and Habeck (1991, pp. 1–75).

TABLE 1—SUMMARY OF HISTORIC FLORIDA LEAFWING SURVEYS—Continued

Population	Ownership	Years	Size or density numbers of adult butterflies	Source
Everglades National Park—Long Pine Key	Federal—NPS	1988–1989	3.7 per ha (1.5 per acre).	Hennessey and Habeck (1991, pp. 1–75).
Everglades National Park—Long Pine Key	Federal—NPS	1994–1995	22 observed	Emmel *et al.* (1995, p. 14).
National Key Deer Refuge—Big Pine Key	Federal—USFWS	1994–1995	19 observed	Emmel *et al.* (1995, p. 14).
National Key Deer Refuge—Watson Hammock.	Federal—USFWS	1997–1998	3.1 per ha (1.2 per acre).	Salvato (1999, p. 52).
Everglades National Park—Long Pine Key	Federal—NPS	1997–1998	2.4 per ha (1 per acre)	Salvato (1999, p. 52).

Surveys by Salvato and Salvato (2010c, pp. 139–140) indicate the average number of adult Florida leafwings recorded annually on Big Pine Key declined from a high of 11 per ha (4.4 per ac) in 1999 to 0 from late 2006 onward, based on monthly (1999 to 2006) or quarterly (2007 to 2012) surveys. Similar studies in Long Pine Key indicated that the average number of leafwings recorded annually ranged from a high of 22.5 per ha (9 per ac) (1999) to 1.5 per ha (0.6 per ac) (2005), based on monthly surveys conducted from 1999 through 2008 (Salvato and Salvato 2010a, p. 93).

Ongoing surveys conducted by Salvato (pers. comm. 2012) from 2009 to 2012 have recorded an average abundance of 2.6 adult Florida leafwings per ha (1 per ac), in Long Pine Key in ENP. In addition, Salvato and Salvato (2010a, p. 96) and Salvato (pers. comm. 2012) have encountered leafwing populations elsewhere within Long Pine Key as well as adjacent habitats within ENP (Palma Vista Hammock and several former agricultural and military lands) during 2005 to 2012. ENP staff also monitors leafwing larval densities at several transects within Long Pine Key monthly as part of studies on the recovery time of pineland croton in response to prescribed burns (Land, pers. comm. 2012a). Ongoing surveys conducted by ENP staff from 2005 to present have encountered approximately 34 and 216 leafwing adults and larvae, respectively, throughout Long Pine Key (Land, pers. comm. 2012a; Sadle, pers. comm. 2013b).

No leafwings have been documented on Big Pine Key in the Florida Keys since 2006 (Salvato and Salvato 2010c, p. 139). On the mainland, Salvato (pers. comm. 2012) has found that the extant leafwing population within ENP is maintained at several hundred or fewer, although it varies greatly depending upon season and other factors. However, Minno (pers. comm. 2009) estimated the extant leafwing population size at less than 100 at any given period.

In ENP, the butterfly is most often encountered from late fall through spring, and less abundantly during the summer (Salvato and Salvato 2010a, p. 95; Land, pers. comm. 2012b). However, the leafwing appeared to maintain a consistent year-round phenology (reproductive life cycle) when it occurred on Big Pine Key (Salvato and Salvato 2010a, p. 95; 2010c, p. 140), with a slight peak in abundance during the summer. Ongoing natural history studies of the leafwing by Salvato and Salvato (Salvato, pers. comm. 2012) designed to evaluate mortality factors amongst the butterfly's immature stages have identified a suite of predators, parasitoids, and pathogens that may substantially influence annual variability.

Bartram's Scrub-Hairstreak

Based on the results of historic (Baggett 1982, p. 80; Schwartz 1987, p. 16; Hennessey and Habeck 1991, pp. 117–119; Smith *et al.* 1994, p. 118; Emmel *et al.* 1995, pp. 1–24; Worth *et al.* 1996, pp. 62–65; Schwarz *et al.* 1996, pp. 59–61) and recent (Salvato 1999, p. 1; 2001, p. 8; 2003, p. 53; Salvato and Hennessey 2004, p. 223; Minno and Minno 2009, p. 76; Salvato and Salvato 2010b, p. 154; C. Anderson pers. comm. 2012a; Land pers. comm. 2012a) surveys and natural history studies, there are extant Bartram's scrub-hairstreak metapopulations in ENP and locally within pineland fragments in mainland Miami-Dade County, and on Big Pine Key in Monroe County. Results from all known historical surveys are provided in table 2. More recent studies are discussed below.

TABLE 2—SUMMARY OF HISTORIC BARTRAM'S SCRUB-HAIRSTREAK SURVEYS

Population	Ownership	Years	Size or density numbers of adult butterflies	Source
National Key Deer Refuge—Big Pine Key	Federal—USFWS	1985–1986	20 observed or collected.	Schwartz (1987, p. 16).
National Key Deer Refuge—Big Pine Key	Federal—USFWS	1988–1989	3.9 per ha (1.6 per ac)	Hennessey and Habeck (1991, pp. 49–50).
Everglades National Park—Long Pine Key	Federal—NPS	1988–1989	0.5 per ha (0.2 per ac)	Hennessey and Habeck (1991, pp. 49–50).
Everglades National Park—Long Pine Key	Federal—NPS	1994–1995	7 observed	Emmel *et al.* (1995, p. 14).
National Key Deer Refuge—Big Pine Key	Federal—USFWS	1994–1995	9 observed	Emmel *et al.* (1995, p. 14).
National Key Deer Refuge—Big Pine Key	Federal—USFWS	1997–1998	4.3 per ha (1.7 per ac)	Salvato (1999, p. 52).
Everglades National Park—Long Pine Key	Federal—NPS	1997–1998	0 per ha (0 per ac)	Salvato (1999, p. 60).

Ongoing surveys by Salvato and Salvato (unpublished data) indicate the average number of adult Bartram's scrub-hairstreaks recorded annually on Big Pine Key has declined considerably, from a high of 19.3 per ha (7.7 per ac) in 1999 to a low of less than 1 per ha (0.3 per ac) in 2011, based on monthly (1999–2006) or quarterly (2007 to 2012) surveys. Minno and Minno (2009, p. 76) recorded an average of 35 adults annually on Big Pine Key during

monthly surveys conducted from 2006 to 2009. Recent annual North American Butterfly Association (NABA) ''Fourth of July'' counts on Big Pine Key reported zero and one individual hairstreaks during 2011 and 2012, respectively.

In order to more frequently survey hairstreak populations within NKDR, the Service, from 2010 to 2012, has implemented a standardized monitoring method to monitor the butterfly at three core pine rockland locations across Big Pine Key (C. Anderson, pers. comm. 2012a). Since that time, the mean monthly count across sites has ranged from 0.0 to 2.8 (with a standard error of ± 0.33) adult hairstreaks per ha (C. Anderson, pers. comm. 2012a). The maximum adult counts were 15 and 8 adults per ha for 2010 and 2011, respectively; however, the means were not significantly different between years (C. Anderson, pers. comm. 2012a). These densities are much higher than those encountered by Salvato and Salvato (unpublished data) in 2010 and 2011; this disparity may be due to the fact that NKDR has established survey transects at locations with more optimal hostplant abundance, where the latter studies continue to monitor long-term transects (15 to 25 years) that were historic strongholds for the butterfly, but have since become degraded. In other words, NKDR is monitoring at what may be current strongholds, while Salvato and Salvato are documenting the butterfly's status at former strongholds. Since early 2012, North Carolina State University personnel have collaborated with the Service to access detection probabilities, estimate abundances, and measure vegetation characteristics associated with butterfly populations on NKDR.

Due in large part to the benefits of an effective and systematic burn plan in ENP, Salvato and Salvato (2010b, p. 159) and Salvato (pers. comm. 2012) have encountered as many as 6.3 adult Bartram's scrub-hairstreaks per ha (2.5 per acre) annually from 1999 to 2012, based on monthly surveys in Long Pine Key. In addition, Salvato and Salvato (2010b, p. 156) and Salvato (pers. comm. 2012) have also monitored populations of the Bartram's scrub-hairstreak elsewhere within Long Pine Key during 2005–2012 and encountered similar densities. Ongoing surveys conducted by ENP staff from 2005 to present have encountered a total of approximately 24 and 30 hairstreak adults and larvae, respectively, throughout Long Pine Key (Land, pers. comm. 2012a; Sadle, pers. comm. 2013b).

Additional pine rockland fragments within Miami-Dade County that are known to maintain small, localized populations of pineland croton and sporadic occurrences of Bartram's scrub-hairstreak, based on limited survey work, include: Navy Wells (120 ha (297 acres)), Camp Owaissa Bauer (39 ha (99 ac)) (owned and managed by Miami-Dade County), and several parcels within the Richmond Pine Rocklands, including: Larry and Penny Thompson Memorial Park (109 ha (270 ac)), Miami Metro Zoo Preserve (300 ha (740 ac)), Martinez Pineland Park (53 ha (132 ac)), and Coast Guard lands in Homestead (29 ha (72 ac)) (Minno and Minno 2009, pp. 70–76; J. Possley, FTBG, pers. comm. 2010).

Summary of Factors Affecting the Species

Section 4 of the Act (16 U.S.C. 1533), and its implementing regulations at 50 CFR part 424, set forth the procedures for adding species to the Federal Lists of Endangered and Threatened Wildlife and Plants. Under section 4(a)(1) of the Act, we may list a species based on any of the following five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (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.

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

Habitat Loss

The Florida leafwing and Bartram's scrub-hairstreak have experienced substantial destruction, modification, and curtailment of their habitat and range (see Status Assessment section). The pine rockland community of south Florida, on which both butterflies and their hostplant depend, is critically imperiled globally (FNAI 2012, p. 27). Destruction of the pinelands for economic development has reduced this habitat community by 90 percent on mainland south Florida (O'Brien 1998, p. 208). All known mainland populations of the Florida leafwing and Bartram's scrub-hairstreak occur on publicly or privately owned lands that are managed for conservation (table 3). However, any unknown extant populations of these butterflies or suitable habitat that may occur on private land or nonconservation public land, such as within the Richmond Pine Rocklands, are vulnerable to habitat loss.

TABLE 3—LAND OWNERSHIP OF EXTANT FLORIDA LEAFWING AND BARTRAM'S SCRUB-HAIRSTREAK POPULATIONS

Location	Ownership	Size
Bartram's Scrub-Hairstreak		
Big Pine Key	Public—Fish and Wildlife Service Public—Monroe County. Public—FDEP, FWC. Private.	559 ha (1,382 ac).
Everglades National Park—Long Pine Key	Federal—National Park Service	8,029 ha (19,840 ac).
Navy Wells Pineland Preserve	Public—Miami-Dade County	142 ha (353 ac).
Camp Owaissa Bauer	Public—Miami-Dade County	40 ha (99 ac).
Richmond Pine Rocklands	Public—Federal (Coast Guard)	359 ha (889 acres).
	Public—Miami-Dade County (Larry and Penny Thompson Memorial Park, Martinez Pineland Park, Miami Metro Zoo Preserve). Private–University of Miami.	

TABLE 3—LAND OWNERSHIP OF EXTANT FLORIDA LEAFWING AND BARTRAM'S SCRUB-HAIRSTREAK POPULATIONS—Continued

Location	Ownership	Size
Florida Leafwing		
Everglades National Park—Long Pine Key	Federal—National Park Service	8,029 ha (19,840 ac).

Similarly, most of the ecosystems on the Florida Keys have been impacted by humans, through widespread clearing of habitat in the 19th century for farming, or building of homes and businesses; extensive areas of pine rocklands have been lost (Hodges and Bradley 2006, p. 6). Overall, the human population in Monroe County is expected to increase from 79,589 to more than 92,287 people by 2060 (Zwick and Carr 2006, p. 21). All vacant land in the Florida Keys is projected to be developed by then, including lands currently inaccessible for development, such as islands not attached to the Overseas Highway (US 1) (Zwick and Carr 2006, p. 14). However, during 2006, Monroe County implemented a Habitat Conservation Plan (HCP) for Big Pine and No Name Keys. Subsequently, development on these islands has to meet the requirements of the HCP with the resulting pace of development changed accordingly. Furthermore, in order to fulfill the HCP's mitigation requirements, the County has been actively acquiring parcels of high-quality pine rockland, such as The Nature Conservancy's 20-acre Terrestris Tract on Big Pine Key, and managing them for conservation. However, land development pressure and habitat losses may resume when the HCP expires in 2023. If the HCP is not renewed, residential or commercial development could increase to pre-HCP levels. Consequently, remaining suitable habitat for Bartram's scrub-hairstreak and potential habitat for the Florida leafwing could be at significant risk to habitat loss and modification. Further losses will seriously affect the hairstreak's ability to persist in the wild and decrease the possibility of recovery or recolonization by the leafwing.

Fire Management

The threat of habitat destruction or modification is further exacerbated by a lack of adequate fire management (Salvato and Salvato 2010a, p. 91; 2010b, p. 154; 2010c, p. 139). Historically, lightning-induced fires were a vital component in maintaining native vegetation within the pine rockland ecosystem, including pineland croton (Loope and Dunevitz 1981, p. 5; Slocum *et al.* 2003, p. 93; Snyder *et al.* 2005, p. 1; Salvato and Salvato 2010b, p. 154). Resprouting after burns is the primary mechanism allowing for the persistence of perennial shrubs, including pineland croton, in pine habitat (Olson and Platt 1995, p. 101). Without fire, successional climax from tropical pineland to hardwood hammock is rapid, and displacement of native species by invasive nonnative plants often occurs.

Prescribed fire is used throughout the pine rocklands of Long Pine Key (ENP) and has been consistently used for the past 50 years (Loope and Dunevitz 1981, p. 5; Salvato and Salvato 2010b, p. 154). Little is known about the fire history in ENP prior to 1947, and initially fires were suppressed (Slocum *et al.* 2003, p. 93). Fire was reintroduced in the late 1950s, but its role remained poorly understood (Slocum *et al.* 2003, p. 93). However, many of the prescribed burns conducted in Long Pine Key during this earlier time period were quite extensive, with several large areas treated simultaneously. ENP is currently in the process of updating its Fire Management Plan (FMP) and Environmental Assessment, which will assess the impacts of fire on various environmental factors, including listed, proposed, and candidate species (Land, pers. comm. 2011; Sadle, pers. comm. 2013a). Since 2001, ENP fire staff has used partial and systematic prescribed burns to treat the Long Pine Key pine rocklands in their entirety over a 3-year window burning adjacent habitats alternately (National Park Service (NPS) 2005, p. 27). Although this has resulted in restoration of species-rich, herbaceous-dominated pine rocklands in many areas, including resurgence of pineland croton, populations of this hostplant appear fragmented (Salvato and Hennessey 2004, p. 223).

Cyclic and alternating treatment of burn units may have benefited the Florida leafwing throughout Long Pine Key (Salvato and Salvato 2010a, pp. 91–97). The leafwing, with its strong flight abilities, can disperse to make use of adjacent patches of hostplant and then quickly recolonize burned areas following hostplant resurgence (Salvato 1999, p. 5; 2003, p. 53; Salvato and Salvato 2010a, p. 95). Salvato and Salvato (2010a, p. 95) encountered similar adult leafwing densities pre- and postburn throughout their 10-year study within Long Pine Key, suggesting the leafwing can quickly recolonize pine rocklands following a fire. Surveys conducted shortly after burns often found adult leafwings actively exploring the recently burned locations in search of new hostplant growth (Land, pers. comm. 2009; Salvato and Salvato 2008, p. 326; 2010a, p. 95). In most instances croton returned to the burned parts of Long Pine Key within 1 to 3 months postburn; however, it may take up to 6 months before the leafwing will use the new growth for oviposition (Lenczewski 1980, p. 35; Land, pers. comm. 2009; Salvato and Salvato 2010a, p. 95). Land (pers. comm. 2009) indicated that 96 percent of pineland croton burned during prescribed fires on Long Pine Key had resprouted within a few months. Although Salvato and Salvato (2010a, p. 96) occasionally encountered signs of leafwing reproduction within recently burned Long Pine Key locations at approximately 6 weeks postburn, the majority of their observations indicated that oviposition and larval activity increased at about 3 to 6 months postburn. Similarly, Land (pers. comm. 2009) reported finding leafwing larval activity on resprouting croton at 6 months postburn. This finding suggests there may be some lag time between hostplant resurgence and compatibility with recolonization.

The influence of prescribed burns on the status and distribution of the hairstreak and croton is being evaluated by ENP throughout Long Pine Key. The effects of new burn techniques on the Bartram's scrub-hairstreak within Long Pine Key were not immediately obvious (Salvato and Salvato 2010b, p. 159). The hairstreak is rarely encountered more than 5 m (16.4 ft) from its hostplant (Schwartz 1987, p. 16; Worth *et al.* 1996, p. 65; Salvato and Salvato 2008, p. 324). Salvato and Hennessey (2004, p. 224) and Salvato and Salvato (2010b, p. 159) indicate that if the hairstreak is unable to disperse adequately during fire events, then only adults at the periphery of burned areas are likely to escape to adjacent pine rocklands. Ideally, as a result of cyclic burns and multiyear treatment intervals, the

hairstreaks will move from the burned location to adjacent refugia (i.e., unburned areas of croton hostplant) and then back to burned area in numbers equal to or greater than before the fire. Starting in the fall of 2004 and continuing into early 2006, the hairstreak appeared to have benefited with population densities greater than those recorded in any previous studies (Salvato and Salvato 2010b, p. 159), and this trend has continued subsequently (Land pers. comm. 2011, 2012a; Salvato pers. comm. 2012).

ENP is actively coordinating with the Service, as well as other members of the Imperiled Butterfly Working Group to review and adjust the prescribed burn practices outlined in the FMP to help maintain or increase Florida leafwing and Bartram's scrub-hairstreak population sizes, protect pine rocklands, expand or restore remnant patches of hostplants and ensure that short-term negative effects from fire (i.e., loss of hostplants, loss of eggs and larvae) can be avoided or minimized.

Outside of the ENP, Miami-Dade County has implemented various conservation measures, such as burning in a mosaic pattern and on a small scale, during prescribed burns in order to protect the butterflies (Maguire, pers. comm. 2010). Miami-Dade County Parks and Recreation staff has burned several of their conservation lands on a fire return interval of approximately 3 to 7 years. In addition, prescribed burns on large conservation areas, such as Navy Wells, have been conducted in a cyclic and systematic pattern, which has provided refugia within or adjacent to treatment areas. As a result, the Bartram's scrub-hairstreak has retained populations within many of these County-managed conservation lands.

Recent natural or prescribed fire activity on Big Pine Key and adjacent islands within NKDR appears to be insufficient to prevent loss of pine rockland habitat (Carlson *et al.* 1993, p. 914; Bergh and Wisby 1996, pp. 1–2; O'Brien 1998, p. 209; Snyder *et al.* 2005; Bradley and Saha 2009, pp. 28–29; Bradley *et al.* 2011, pp. 1–16). As a result, many of the pine rocklands, across NKDR are being compromised by succession to hardwood hammock (Bradley and Saha 2009, pp. 28–29; Bradley *et al.* 2011, pp. 1–16). Pineland croton, which was historically documented from No Name and Little Pine Keys (Dickson 1955, p. 98; Hennessey and Habeck 1991, p. 4; Carlson *et al.* 1993, p. 923), is now absent from these locations (Emmel *et al.* 1995, p. 6; Salvato and Salvato 2010c, p. 139).

Fire management of pine rocklands in NKDR is hampered by the pattern of land ownership and development; residential and commercial properties are embedded within or in close proximity to pineland habitat (Snyder *et al.* 2005, p. 2; C. Anderson, pers. comm. 2012a). As a result, hand or mechanical vegetation management may be necessary at select locations on Big Pine Key (Emmel *et al.* 1995, p. 11; Minno, pers. comm. 2009; Service 2010, pp. 1–68) to maintain or restore pine rocklands. Clearing, such as that used to create firebreaks, can result in high croton densities. Anderson *et al.* (2012, page numbers not applicable) showed that croton densities were significantly higher in a fire break with annual mechanical treatments than adjacent areas with no management. However, even within fire breaks, hostplant density across NKDR has declined considerably in some areas over the past decade. Salvato and Salvato (unpublished data) have noted as much as a 100 percent loss of pineland croton from several of their long-term survey transects, which occur within both firebreaks and forested pine rocklands. These losses are believed to be due to a combination of mowing activity, habitat modification, and a lack of adequate fire management. Mechanical treatments may be less beneficial than fire because they do not quickly convert debris to nutrients, and remaining leaf litter may suppress croton seedling development; fire has also been found to stimulate seedling germination (C. Anderson, pers. comm. 2010). Because mechanical treatments may not provide the same ecological benefits as fire, NKDR continues to focus efforts on conducting prescribed fire where possible (C. Anderson, pers. comm. 2012a).

The NKDR is attempting to increase the density of hostplants within their pine rockland habitat through the use of prescribed fire. However, the majority of pine rocklands within NKDR are several years departed from the ideal fire return interval (5–7 years) suggested for this ecosystem (Synder *et al.* 2005, p. 2, Bradley and Saha 2011, pp. 1–16). Tree ring and sediment data show that pine rocklands in the lower Keys have burned at least every 5 years and sometimes up to three times per decade historically (Albritton 2009, pp. 123, Horn *et.al.,* 2013, pp. 1–67, Harley 2012, pp. 1–246). Prescribed fire implementation in the lower Keys has been hampered largely due to a shortage of resources, technical challenges, and expense of conducting prescribed fire in a matrix of public and private ownership. However, NKDR is taking steps to monitor croton before and after fire, provide refugia during treatments, and ensure that appropriate corridors are maintained during burns (C. Anderson, pers. comm. 2010). Given the difficulties in prescribed fire implementation on Big Pine Key, other options have been explored to increase the amount of available hostplant for extant Bartram's scrub-hairstreak populations, as well as to restore formerly occupied Florida leafwing habitat on Big Pine Key. For example, NKDR currently is growing pineland croton for use in habitat enhancement activities across the Refuge (more than a thousand have been planted to date) (C. Anderson pers. comm. 2012b).

Climate Change and Sea Level Rise Related to Habitat Loss and Alteration

Climatic changes, including sea level rise, are major threats to south Florida, including the Florida leafwing and Bartram's scrub-hairstreak. Our analyses under the Act 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). The term ''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. Examples include warming of the global climate system, and substantial increases in precipitation in some regions of the world and decreases in other regions. (For these and other examples, see IPCC 2007a, p. 30; and Solomon *et al.* 2007, pp. 35–54, 82–85). 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 use of fossil fuels (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 increases in the most common measure of climate change, average global surface temperature (commonly known as 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 the 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 and 797–811; Ganguly *et al.* 2009, pp. 15555–15558; Prinn *et al.* 2011, pp. 527, 529). See IPCC (2007b, p. 8), for a summary of other global projections of climate-related changes, such as frequency of heat waves and changes in precipitation. Also see IPCC 2011 (entire) for a summary of observations and projections of extreme climate events.

Various changes in climate may have direct or indirect effects on species. These effects 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 (e.g., habitat fragmentation) (IPCC 2007, pp. 8–14, 18–19). Identifying likely effects often involves aspects of climate change vulnerability analysis. 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).

With regard to our analysis for the Florida leafwing and Bartram's scrub-hairstreak, downscaled projections suggest that sea level rise is the largest climate-driven challenge to low-lying coastal areas and refuges in the subtropical ecoregion of southern Florida (U.S. Climate Change Science Program (CCSP) 2008, pp. 5–31, 5–32). The long-term record at Key West shows that sea level rose on average 0.224 centimeters (cm) (0.088 in) annually between 1913 and 2006 (National Oceanographic and Atmospheric Administration (NOAA) 2008, p. 1). This equates to approximately 22.3 cm (8.76 in) over the last 100 years (NOAA 2008, p. 1). IPCC (2008, p. 28) emphasized it is very likely that the average rate of sea level rise during the 21st century will exceed that rate, although it was projected to have substantial geographical variability.

Other processes to be affected by projected warming include temperatures, rainfall (amount, seasonal timing, and distribution), and storms (frequency and intensity). The Massachusetts Institute of Technology (MIT) modeled several scenarios combining various levels of sea level rise, temperature change, and precipitation differences with population, policy assumptions, and conservation funding changes. All of the scenarios, from small climate change shifts to major changes, indicate significant effects on the Florida Keys.

The Nature Conservancy (TNC) modeled several scenarios for the Florida Keys, and predicted that sea level rise will first result in the conversion of habitat, and eventually the complete inundation of habitat. In the best-case scenario, by the year 2100, a rise of 18 cm (7 in) would result in the inundation of 745 ha (1,840 ac) (34 percent) of Big Pine Key and the loss of 11 percent of the island's upland habitat (TNC 2010, p. 1). In the worst-case scenario, a rise of 140 cm (4.6 ft would result in the inundation of about 2,409 ha (5,950 ac) (96 percent) and the loss of all upland habitat on the Key (TNC 2010, p. 1). Extant populations of Bartram's scrub-hairstreak in the pine rocklands on Big Pine Key are located just slightly above mean sea level, and saturation or increase in salinity of the soil would correspondingly change the vegetation and habitat structure making the butterfly's survival at this location in the Keys very unlikely. In addition, the Florida leafwing also occurred on Big Pine Key until 2006, within the same locations as extant Bartram's scrub-hairstreak populations. Re-establishment of the Florida leafwing to this island will be a major component in recovering the butterfly. The loss of this portion of the Florida leafwing's range will further reduce their overall resiliency to threats and limit their capacity for survival and recovery.

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. 9, 12–13), and loss of pine rockland in the Keys (Ross *et al.* 1994, pp. 144, 151–155). Furthermore, Ross *et al.* (2009, pp. 471–478) suggested that interactions between sea level rise and pulse disturbances (e.g., storm surges) can cause vegetation to change sooner than projected based on sea level alone. Alexander (1953, pp. 133–138) attributed the demise of pinelands on northern Key Largo to salinization of the groundwater in response to sea level rise. Patterns of human development will also likely be significant factors influencing whether natural communities can move and persist (IPCC 2008, p. 57; CCSP 2008, p. 7–6).

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 2011, p. 58). Climate changes are forecasted to extend fire seasons and the frequency of large fire events throughout the Coastal Plain (Wear and Greis 2011, p. 65). Increases in the scale, frequency, or severity of wildfires could also have severe ramifications on the Florida leafwing and Bartram's scrub-hairstreak, considering their dependence on pine rocklands and general vulnerability due to their reduced population size, restricted range, few colonies, low fecundity, and relative isolation (see *Factor E*).

The ranges of recent projections of global sea level rise (Pfeffer *et al.* 2008, p. 1340; Vermeer and Rahmstorf 2009, p. 21530; Grinsted *et al.* 2010, pp. 469–470; Jevrejeva *et al.* 2010, Global Climate Change Impacts in the United States 2009, pp. 25–26) all indicate substantially higher levels than the projection by the IPCC in 2007, suggesting that the impact of sea level rise on south Florida could be even greater than indicated above. These recent studies also show a much larger difference (approximately 0.9 to 1.2 m (3 to 4 ft)) from the low to the high ends of the ranges, which indicates that the magnitude of global mean sea level rise at the end of this century is still quite uncertain.

Alternative Future Landscape Models

Various model scenarios developed at MIT 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 Service used various MIT scenarios in combination with extant and historic Florida leafwing and Bartram's scrub-hairstreak occurrences and remaining hostplant-bearing pine rocklands to predict what may occur to the butterflies and their habitat.

In the best-case scenario, which assumes low sea level rise, high financial resources, proactive planning, and only trending population growth, analyses suggest that the Big Pine Key population of the Bartram's scrub-hairstreak may be lost or greatly reduced. Based upon the above assumptions, extant butterfly populations on Big Pine Key (Bartram's scrub-hairstreak) and Long Pine Key (Florida leafwing and Bartram's scrub-hairstreak) appear to be most susceptible for future losses, with losses attributed to increases in sea level and human population. In the worst-case scenario, which assumes high sea level rise, low financial resources, a ''business as usual'' approach to planning, and a doubling of human population, the habitat at Big Pine Key and Long Pine Key may be lost and the loss of habitat at Long Pine Key resulting in the complete extirpation of the Florida leafwing. Under the worst-case scenario, pine rockland habitat would remain within both Navy Wells and the Richmond Pine Rocklands, both of which currently retain Bartram's scrub-hairstreak populations. Actual impacts may be greater or less than anticipated based upon high variability of factors involved (e.g., sea level rise, human population growth) and assumptions made.

Everglades Restoration

Projects designed to restore the historic hydrology of the Everglades and other natural systems in southern Florida (collectively known as the Comprehensive Everglades Restoration Project (CERP)) may produce collateral impacts to extant pine rockland within Long Pine Key. Salvato (pers. comm. 2012) noted substantial flooding of pine rocklands at the gate 11 nature trail in Long Pine Key following Hurricane Isaac (August 2012) and subsequent above-average rainfall in the region. Although Long Pine Key has experienced storm damages in the recent past (Salvato and Salvato 2010a, p. 96), none of the prior activity produced the level (several feet) or duration (more than 2 months) of inundation noted in the aftermath of Isaac. However, by mid-December 2012, Salvato noted no apparent lasting influence on croton health or abundance from the inundation. Sadle (pers. comm. 2012) suggests various CERP projects (C–111 spreader canal; L–31N seepage barrier), specifically the operation of pumps and associated detention areas along the ENP boundary, may influence select portions of eastern Long Pine Key, including pineland croton populations at gate 11. However, Pace (pers. comm. 2013) attributed the pine rockland flooding event of late 2012 more to localized and above-average rainfall patterns than to a change in water management practices. Analysis of the hydrology associated with operation of these CERP-related structures along the Everglades boundary will be conducted following the initial years of operation. However, Service and NPS biologists realize the need to assess this potential threat.

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

The National Wildlife Refuge System Improvement Act of 1997 and the Fish and Wildlife Service Manual (601 FW 3, 602 FW 3) require maintaining biological integrity and diversity, comprehensive conservation planning for each refuge, and set standards to ensure that all uses of refuges are compatible with their purposes and the Refuge System's wildlife conservation mission. The comprehensive conservation plans (CCP) address conservation of fish, wildlife, and plant resources and their related habitats, while providing opportunities for compatible wildlife-dependent recreation uses. An overriding consideration reflected in these plans is that fish and wildlife conservation has first priority in refuge management, and that public use be allowed and encouraged as long as it is compatible with, or does not detract from, the Refuge System mission and refuge purpose(s). The CCP for the Lower Florida Keys National Wildlife Refuges (NKDR, Key West National Wildlife Refuge, and Great White Heron National Wildlife Refuge) provides a description of the environment and priority resource issues that were considered in developing the objectives and strategies that guide management over the next 15 years. The CCP promotes the enhancement of wildlife populations by maintaining and enhancing a diversity and abundance of habitats for native plants and animals, especially imperiled species that are found only in the Florida Keys. The CCP also provides for obtaining baseline data and monitoring indicator species to detect changes in ecosystem diversity and integrity related to climate change. In the Lower Key Refuges, CCP management objective no. 11 provides specifically for maintaining and restoring butterfly populations of special conservation concern, including the Bartram's scrub-hairstreak and Florida leafwing butterflies.

As Federal candidates, the Florida leafwing and Bartram's scrub-hairstreak are afforded some protection through sections 7 and 10 of the Act and associated policies and guidelines. Service policy requires candidate species be treated as proposed species for purposes of intra-Service consultations and conferences where the Service's actions on National Wildlife Refuges may affect candidate species. Federal action agencies (e.g., Service, NPS) are to consider the potential effects (e.g., prescribed fire,

pesticide treatments) to these butterflies and their habitat during the consultation and conference process. Applicants and action agencies are encouraged to consider candidate species when seeking incidental take for other listed species and when developing habitat conservation plans. However, candidate species do not receive the same level of protection that a listed species would under the Act.

The NPS is also currently preparing a revised General Management Plan for ENP (Sadle, NPS, pers. comm. 2013a). ENP's current Management Plan (initiated in 1979) serves to protect, restore, and maintain natural and cultural resources at the ecosystem level (NPS 2000, p. 10). The current GMP is not regulatory and its implementation is not mandatory. In addition, this GMP does not specifically address either the Florida leafwing or Bartram's scrub-hairstreak.

Fairchild Tropical Botanic Gardens (FTBG), with the support of various Federal, State, local and nonprofit organizations, has established the ''Connect to Protect Network.'' The objective of this program is to encourage widespread participation of citizens to create corridors of healthy pine rocklands by planting stepping-stone gardens and rights-of-way with native pine rockland species, and restoring isolated pine rockland fragments. By doing this, FTBG hopes to increase the probability that pollinators can find and transport seeds and pollen across developed areas that separate pine rocklands fragments to improve gene flow between fragmented plant populations and increase the likelihood that these species will persist over the long term. Although this project may serve as a valuable component toward the conservation of pine rockland species, it is 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 Florida leafwing and Bartram's scrub-hairstreak that have operated in the past, are impacting the butterflies now, and will continue to impact these butterflies 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 these butterflies at greater risk. Both butterflies may be impacted when pine rocklands are converted to other uses or when lack of fire causes the conversion to hardwood hammocks or other habitats that are unsuitable for these butterflies and their host plant. Routine land management activities (e.g., prescribed fire) may also cause impacts to hostplant abundance and availability of nectar sources. Environmental effects resulting from climatic change, including sea level rise, are occurring now and are expected to become severe in the future, resulting in additional habitat losses. Although efforts are being made to conserve natural areas and apply prescribed fire, the long-term effects of large-scale and wide-ranging habitat modification, destruction, and curtailment will last into the future.

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

Collection

Rare butterflies and moths are highly prized by collectors, and an international trade exists in specimens for both live and decorative markets, as well as the specialist trade that supplies hobbyists, collectors, and researchers (Collins and Morris 1985, pp. 155–179; Morris *et al.* 1991, pp. 332–334; Williams 1996, pp. 30–37). The specialist trade differs from both the live and decorative market in that it concentrates on rare and threatened species (U.S. Department of Justice (USDJ) 1993, pp. 1–3; *United States* v. *Skalski et al.,* Case No. CR9320137, U.S. District Court for the Northern District of California (USDC) 1993, pp. 1–86). In general, the rarer the species, the more valuable it is; prices can exceed $25,000 for exceedingly rare specimens. For example, during a 4-year investigation, special agents of the Service's Office of Law Enforcement executed warrants and seized more than 30,000 endangered and protected butterflies and beetles, with a total wholesale commercial market value of about $90,000 in the United States (USDJ 1995, pp. 1–4). In another case, special agents found at least 13 species protected under the Act, and another 130 species illegally taken from lands administered by the Department of the Interior and other State lands (USDC 1993, pp. 1–86; Service 1995, pp. 1–2). Law enforcement agents routinely see butterfly species protected under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) during port inspections in Florida, often without import declarations or the required CITES permits (McKissick, Service Law Enforcement, pers. comm. 2011).

In the past, when the Florida leafwing and Bartram's scrub-hairstreak were widespread on Big Pine Key and throughout southern Miami-Dade County, collecting likely exerted little pressure on these butterfly populations. At present, even limited collection from the small, remaining populations could have deleterious effects on reproductive and genetic viability and thus could contribute to their eventual extinction (see Factor E—Effects of Few, Small Populations and Isolation, below). Collection, which is prohibited on conservation lands, could occur (e.g., ENP, NKDR, State or County owned lands) without being detected, because these areas are all not actively patrolled (see Factor D—*The Inadequacy of Existing Regulatory Mechanisms,* below). Similarly, in some areas such as on Big Pine Key, where numerous pine rockland parcels within NKDR are interspersed among residential areas, there is no signage indicating that collection is prohibited (Salvato, pers. comm. 2012). Consequently, the potential for collection of eggs, larvae, pupae, and adult butterflies exists, and such collection could go undetected, despite the protection provided on Federal or other public lands.

We have direct evidence of interest in the collecting, as well as proposed commercial sale, of the Florida leafwing and Bartram's scrub-hairstreak. Salvato (pers. comm. 2011) has also been contacted by several individuals requesting specimens of the Florida leafwing, as well as information regarding locations where both butterflies may be collected in the field. Salvato (pers. comm. 2012) observed several individuals collecting butterflies at Navy Wells during 2005, including times when Bartram's scrub-hairstreak was present at this site.

We are also aware of multiple Web sites that offer or have offered specimens of south Florida butterflies for sale that are candidates for listing under the Act (Minno, pers. comm. 2009; Nagano, pers. comm. 2011; Olle, pers. comm. 2011). Until recently, one Web site offered male and female Florida leafwing specimens for €110.00 and €60.00 (euros), respectively (approximately $144 and $78). It is unclear from where the specimens originated or when they were collected, but this butterfly is now mainly restricted to ENP where collection is prohibited. The same Web site currently offers specimens of Bartram's scrub-hairstreak for €10.00 ($13). It is unclear from where these specimens originated or when they were collected. The hairstreak can be found on private lands on Big Pine Key and perhaps locally within Miami-Dade County. However, given that the majority of known populations of both butterflies now

occur within protected Federal, State, and County lands, it is highly likely that some specimens are being poached.

Scientific Research

Some techniques (e.g., capture, handling) used to understand or monitor the leafwing and hairstreak butterflies have the potential to cause harm to individuals or habitat. Visual surveys, transect counts, 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. Mark–recapture, a common method used to determine population size, has been used by some researchers to monitor Florida leafwing and Bartram's scrub-hairstreak populations (Emmel *et al.* 1995, p. 4; Salvato 1999, p. 24). This method has received some criticism. While mark–recapture may be preferable to other sampling estimates (e.g., count-based transects) in obtaining demographic data when used in a proper design on appropriate species, such techniques may also result in deleterious impacts to captured butterflies (Mallet *et al.* 1987, pp. 377–386; Murphy 1988, pp. 236–239; Haddad *et al.* 2008, pp. 929–940).

Although effects may vary depending upon taxon, technique, or other factors, some studies suggest that marking may damage (wing damage) or kill butterflies or alter their behaviors (Mallet *et al.* 1987, pp. 377–386; Murphy 1988, pp. 236–239). Salvato (pers. comm. 2012) ceased using mark-recapture shortly after initiating his long-term leafwing studies when he realized how much the tagging altered from the butterflies' cryptic (camouflage) underside as individuals alit (rested) on pineland foliage. Murphy (1988, p. 236) and Mattoni *et al.* (2001, p. 198) indicated that studies on various lycaenids (small butterflies known as hairstreaks and blues) have demonstrated mortality and altered behavior as a result of marking. Conversely, other studies have found that marking did not harm individual butterflies or populations (Gall 1984, pp. 139–154; Orive and Baughman 1989, p. 246; Haddad *et al.* 2008, p. 938). Emmel *et al.* (1995, p. 4) conducted mark-recapture studies on the hairstreak and noted no detrimental effects. In addition several individuals were re-encountered (recaptured) during the days following marking. However, researchers currently studying the populations of the endangered Miami blue in the Florida Keys have opted not to use mark–release–recapture techniques due to the potential for damage to this small, fragile lycaenid (Haddad and Wilson 2011, p. 3).

Summary of Factor B

Collection interest of imperiled butterflies is high, and there are ample examples of collection pressure contributing to extirpations. Although we do not have information indicating the extent to which the Florida leafwing and Bartram's scrub-hairstreak are being collected, we have evidence of both being recently offered for sale. Even limited collection from the remaining metapopulations could have deleterious effects on reproductive and genetic viability of both butterflies and could contribute to their extinction. Although the effects of various scientific studies on butterflies vary amongst species, we do have limited information to suggest that techniques such as mark–recapture may have deleterious impacts to the Florida leafwing and Bartram's scrub-hairstreak. We consider collection, including for scientific research, to be a significant threat to both butterflies due to the few remaining metapopulations, reduced population sizes, restricted range, and because collection could potentially occur at any time.

Factor C. Disease or Predation

Florida Leafwing

A number of predators have been documented to impact Florida leafwings throughout their life cycle. One of the earliest natural history accounts of the leafwing (Matteson 1930, p. 8) reported ants as predators of leafwing eggs in Miami. On Big Pine Key, Hennessey and Habeck (1991, p. 17) encountered a pupa of the Florida leafwing being consumed by ants. Land (pers. comm. 2009) observed a native twig ant (*Pseudomyrmex pallidus*) carrying a young leafwing larva in Long Pine Key. Salvato and Salvato (2012, p. 3) witnessed an older leafwing larva repelling *P. pallidus* attacks while attempting to pupate. Minno (pers. comm. 2009) noted that the larger nonnative graceful twig ant (*Pseudomyrmex gracilis*) is also known to consume immature butterflies and moths. Salvato and Salvato (2012, p. 3) have observed a graceful twig ant attempting to capture a young leafwing larva. Cannon (2006, pp. 7–8) reported high mortality of giant and Bahamian (*P. a. andraemon*) swallowtail eggs from a nonnative species of twig ant (*Pseudomyrmex* spp.) on Big Pine Key, within habitat formerly occupied by the Florida leafwing. Both native and nonnative *Pseudomyrmex* ants are abundant within Long Pine Key and are frequently encountered patrolling the racemes of pineland croton. Forys *et al.* (2001, p. 257) found high mortality among immature giant swallowtails (*Papilio cresphontes*) from imported red fire ant (*Solenopsis invicta*) predation in experimental trials and suggested other butterflies in southern Florida might also be influenced.

Additional predators of immature Florida leafwings include spiders (Rutkowski 1971, p. 137; Glassberg *et al.* 2000, p. 99; Salvato and Salvato 2010e, p. 6; 2011a, p. 103; 2012c, p. 3), ambush bugs (Salvato and Salvato 2008, p. 324), and possibly mites (Salvato and Salvato 2010e, p. 6). Salvato and Salvato (unpublished data) have examined the bite marks on wings of numerous adults in the field suggesting a variety of birds and lizards are among the predators of this butterfly.

A number of parasites have been documented to impact Florida leafwings throughout their life cycle. Hennessey and Habeck (1991, p. 16) and Salvato and Hennessey (2004, p. 247) noted that leafwing egg mortality within ENP and Big Pine Key, from trichogrammid wasp (*Trichogramma* sp. near (nr) *pretiosum*) parasitism, ranged from 70 to 100 percent. Salvato and Salvato (2011b, p. 2) continually encounter leafwing eggs that have been attacked by *Trichogramma* sp. nr *pretiosum,* suggesting this wasp remains a consistent parasitoid for the leafwing within ENP.

Caldas (1996, p. 89), Muyshondt (1974, pp. 306–314), DeVries (1987, p. 21) and Salvato and Hennessey (2003, p. 247) each indicated high parasitism rates from tachinid flies for larvae of *Anaea* or similar genera. Hennessey and Habeck (1991, p. 17) and Salvato *et al.* (2009, p. 101) each encountered Florida leafwing larvae within ENP that had been parasitized by *Chetogena scutellaris* (Diptera: Tachinidae). Ongoing studies of leafwing larvae in Long Pine Key have indicated that *C. scutellaris* serves as a consistent mortality factor to the butterfly in this part of its range (Salvato *et al.* 2009, p. 101; Salvato and Salvato 2010a, p. 95). Current studies suggest that leafwing mortality from the fly can vary considerably from year to year, thereby also influencing overall population numbers of the butterfly. In 2011, nearly all leafwing larvae observed to be parasitized by *C. scutellaris,* died prior to pupation. Conversely, in winter of 2012, three of four leafwing larvae observed to be heavily parasitized by the fly were found to successfully pupate and emerge (Salvato and Salvato 2012, p. 3).

Salvato *et al.* (2008, p. 237) observed a biting-midge, *Forcipomyia* (*Microhelea*) *fuliginosa* (Diptera: Ceratopogonidae), feeding on a young Florida leafwing larva within ENP.

Ongoing studies of *F.* (*M.*) *fuliginosa* and a second biting midge *F.* (*M.*) *eriophora* (Salvato *et al.* 2012, p. 232) indicate they consistently parasitize leafwing larvae within Long Pine Key throughout their development.

Salvato and Salvato (2012, p. 1) have monitored Florida leafwing immature development in the field for several years at Long Pine Key. To date these studies have measured mortality rates of more than 70 percent for immature leafwing, individuals dying from various parasites, predators, and other factors such as fungal pathogens (Salvato and Salvato 2012, p. 1). The majority of mortality noted thus far in these studies has occurred in the earliest, immature stages.

Bartram's Scrub-Hairstreak

Native parasites and predators have been documented to impact Bartram's scrub-hairstreaks. Hennessey and Habeck (1991, p. 19) collected an older hairstreak larva on Big Pine Key from which a single braconid wasp emerged during pupation. During 2010, Salvato *et al.* (2012, p. 113) encountered a hairstreak larva within Long Pine Key that had been parasitized by *C. scutellaris.* These are the only known records for a larval parasitoid on this butterfly. Tracking the fate of hairstreak pupae is extremely difficult because they pupate in the ground litter (Worth *et al.* 1996, p. 63). Collection of other parasitized hairstreak larvae is needed to determine the influence of parasitism on its early stages (Salvato and Hennessey 2004, p. 225).

Salvato and Salvato (2010d, p. 71) observed erythraeid larval mite parasites on an adult Bartram's scrub-hairstreak in Long Pine Key. Although mite predation on butterflies is rarely fatal (Treat 1975, pp. 1–362), the role of parasitism by mites in the natural history of the hairstreak requires further study. Salvato and Salvato (2008, p. 324) have observed dragonflies (Odonata) preying on adult hairstreaks. Crab spiders, orb weavers, ants, and number of other predators discussed as mortality factors for the leafwing have also been frequently observed on croton during hairstreak surveys and may also prey on hairstreak adults and larvae (Salvato and Hennessey 2004, p. 225; Salvato, pers. comm. 2012). NKDR biologists have witnessed nonnative Cuban anoles (*Anolis equestris*) attempting to prey on adult Bartram's scrub-hairstreaks (C. Anderson, pers. comm. 2013). Minno and Minno (2009, p. 72) also cite nonnative predators such as ants as a major threat to both butterflies.

Summary of Factor C

At this time, it is not known to what extent predation, parasitism, or disease may act as threats to the Florida leafwing and Bartram's scrub-hairstreak. Studies have documented a wide array of predators and parasitoids and, in some cases, high levels of mortality amongst immature leafwings, throughout development. Although many of the mortality factors of immature leafwing have also been shown to influence the hairstreak, to date, these studies have been limited. Disease, in the form of viruses or fungal pathogens, is known to cause mortality of the young leafwing larvae; these factors may also influence the young hairstreak larvae. Given the leafwing and hairstreak butterflies' low numbers and few occurrences, and limited distributions, it is unclear how the leafwing and hairstreak will respond to these factors.

D. The Inadequacy of Existing Regulatory Mechanisms

Under this factor, we examine whether existing regulatory mechanisms are inadequate to address the threats to the species discussed under the other factors. 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.

Having evaluated the significance of the threat as mitigated by any such conservation efforts, we analyze under Factor D the extent to which existing regulatory mechanisms are inadequate to address the specific threats to the species. Regulatory mechanisms, if they exist, may reduce or eliminate the impacts from one or more identified threats. In this section, we review existing State and Federal regulatory mechanisms to determine whether they effectively reduce or remove threats to the Florida leafwing and Bartram's scrub-hairstreak butterflies.

Existing regulatory mechanisms that could provide some protection for the Florida leafwing and Bartram's scrub-hairstreak butterflies include: (1) the National Park Service Organic Act and its implementing regulations; (2) the National Wildlife Refuge System Administration Act (16 U.S.C. 668dd–ee) as amended, and the Refuge Recreation Act (16 U.S.C. 460k–460k–4) and their implementing regulations.

Federal

National Park Service (NPS) regulations at 36 CFR 2.1 and 2.2 prohibit visitors from harming or removing wildlife, listed or otherwise, from ENP. In addition, NPS regulation 36 CFR 2.5 prohibits visitors from conducting research or collecting specimens without a permit. Although ENP was not able to provide specific information concerning poaching of butterflies or enforcement of NPS regulations protecting the butterflies and their habitats from harm the apparent online sales of the butterflies suggests that poaching could be occurring. Insufficient implementation or enforcement could become a threat to the two butterflies in the future if they continue to decline in numbers.

Special Use Permits (SUPs) are issued by the Refuges as authorized by the National Wildlife Refuge System Administration Act (16 U.S.C. 668dd–ee) as amended, and the Refuge Recreation Act. The Service's South Florida Ecological Services Office and NKDR coordinate annually on potential impacts to the Florida leafwing and Bartram's scrub-hairstreak prior to issuance of a SUP to the FKMCD (see Factor E—Pesticides, below). In addition, as discussed above (Factor A—Conservation Efforts to Reduce the Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range), the CCP for the Lower Key Refuges provides specifically for maintaining and restoring butterfly populations within NKDR, including the Bartram's scrub-hairstreak and Florida leafwing butterflies.

State

The Florida leafwing and Bartram' scrub-hairstreak butterflies are not currently listed by the State of Florida ESA, so there are no existing regulations designated to protect them.

Local

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. We have no information to suggest that other counties within the range of the leafwing and hairstreak have regulatory mechanisms that provide any protections for these butterflies.

Summary of Factor D

In summary, existing regulatory mechanisms that help conserve the Florida leafwing and Bartram's scrub-hairstreak are present on Federal lands (ENP and NKDR) and within Miami-Dade County conservation areas. The butterflies are provided limited or no protections on State of Florida or Monroe County lands. Despite the existing regulatory mechanisms, habitat loss and modification, inconsistent fire management, poaching, and pesticide applications suggest that existing regulatory mechanisms have not been sufficient to provide for the conservation of either species.

E. Other Natural or Manmade Factors Affecting Its Continued Existence

Effects of Few, Small Populations and Isolation

The Florida leafwing and Bartram's scrub-hairstreak are vulnerable to extinction due to their severely reduced range, reduced population size, lack of metapopulation structure, few remaining populations, and relative isolation. Abundance of the Florida leafwing and Bartram's scrub-hairstreak is not known, but each butterfly is estimated to number in the hundreds, and at times, possibly much lower. Although highly dependent on individual species considered, a population of 1,000 has been suggested as marginally viable for an insect (Schweitzer, TNC, pers. comm. 2003). Schweitzer (pers. comm. 2003) has also suggested that butterfly populations of less than 200 adults per generation would have difficulty surviving over the long term. In comparison, in a review of 27 recovery plans for listed insect species, Schultz and Hammond (2003, p. 1377) found that 25 plans broadly specified metapopulation features in terms of requiring that recovery include multiple population areas (the average number of sites required was 8.2). The three plans that quantified minimum population sizes as part of their recovery criteria for butterflies ranged from 200 adults per site (Oregon silverspot *(Speyeria zerene hippolyta))* to 100,000 adults (Bay checkerspot *(Euphydryas editha bayensis)*) (Schulz and Hammond 2003, pp. 1374–1375).

Schultz and Hammond (2003, pp. 1372–1385) used population viability analyses to develop quantitative recovery criteria for insects whose population sizes can be estimated and applied this framework in the context of the Fender's blue *(Icaricia icarioides fenderi),* a butterfly listed as endangered in 2000 due to the threats on the remaining reduced population and limited remaining habitat. They found the Fender's blue to be at high risk of extinction due to agriculture practices, development activities, forestry practices, grazing, roadside maintenance, and commercial Christmas tree farming.

Losses in diversity within populations of the Florida leafwing and Bartram's scrub-hairstreak may have already occurred (Salvato, pers. comm. 2012). The leafwing and hairstreak have been extirpated from several locations where they were previously recorded (Baggett 1982, pp. 78–81; Salvato and Hennessey 2003, p. 243; 2004 p. 223). Initially described from Brickell Hammock in Coral Gables, Florida (present day Vizcaya Museum and Gardens), in the 1940s (Salvato, pers. comm. 2012), mainland populations of the leafwing have subsequently retreated with the loss, fragmentation and degradation of native pine rocklands throughout Miami-Dade County (Baggett 1982, pp. 78–81; Salvato and Hennessey 2003, p. 243). At present, the leafwing is extant only within ENP, and ongoing surveys suggest the butterfly actively disperses throughout the Long Pine Key region of the Park (Salvato and Salvato 2010, p. 91; 2010c, p. 139). Once locally common at Navy Wells and the Richmond Pine Rocklands (which occur approximately 8 and 27 km (5 and 17 mi) to the northeast of ENP, respectively), leafwings are not known to have bred at either location in more than 25 years (Salvato and Hennessey 2003, p. 243; Salvato pers. comm. 2012). In the lower Florida Keys, the leafwing had maintained a stronghold for many decades on Big Pine Key, within NKDR, until 2006 when that population disappeared due to a variety of factors (Salvato and Salvato 2010c, pp. 139–140).

The Bartram's scrub-hairstreak is extant within ENP, Navy Wells, Camp Owaissa Bauer, Richmond Pine Rocklands, as well as on Big Pine Key (Baggett 1982, pp. 80–81; Smith *et al.* 1994, pp. 118–119; Salvato and Salvato 2010b, p. 154). However, given the limited dispersal abilities of this butterfly, the distance between these sites, (Worth *et al.* 1996, p. 63; Salvato and Hennessey, p 223) and their fragmentation, it is unlikely there is any genetic exchange between locations.

Another south Florida lycaenid, the Miami blue (*Cyclargus thomasi bethunebakeri*), also appears to have been impacted by relative isolation similar to that of the hairstreak. Over the past decade, this blue butterfly was known from only two contemporary populations, Bahia Honda Key and Key West National Wildlife Refuge. Saarinen (2009, p. 79) suggested that the separation of genetic exchange between these extant populations was only recent (within the past few decades). Despite fluctuations in annual and seasonal population sizes, the Bahia Honda blue population was thought to have retained an adequate amount of genetic diversity to maintain the butterfly. However, as of 2010, the Miami blue population on the island was extirpated.

Extant hairstreak populations are likely experiencing a similar lack of continuity in genetic exchange given their current fragmented distribution. Based upon modeling with a different butterfly species, Fleishman *et al.* (2002, pp. 706–716) argued that factors such as habitat quality may influence metapopulation dynamics, driving extinction and colonization processes, especially in systems that experience substantial natural and anthropogenic environmental variability (see *Environmental Stochasticity* below). If only one or a few metapopulations remain, it is absolutely critical that remaining genetic diversity and gene flow are retained. Conservation decisions to augment or reintroduce populations should not be made without careful consideration of habitat availability, genetic adaptability, the potential for the introduction of maladapted genotypes, and other factors (Frankham 2008, pp. 325–333; Saarinen *et al.* 2009, p. 36; See Factors A–D above).

In general, isolation, whether caused by geographic distance, ecological factors, or reproductive strategy, will likely prevent the influx of new genetic material and can result in a highly inbred population with low viability or fecundity (Chesser 1983, p. 68). Natural fluctuations in rainfall, hostplant vigor, or predation may weaken a population to such an extent that recovery to a viable level would be impossible. Isolation of habitat can prevent recolonization from other sites and result in extinction. The leafwing and hairstreak are restricted to one (leafwing) or a few small (hairstreak) localized populations. The extent of

habitat fragmentation makes these butterflies vulnerable to extinction.

Environmental Stochasticity

The climate of southern Florida and the Florida Keys 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.

According to the Florida Climate Center, Florida is by far the most vulnerable State in the United States to hurricanes and tropical storms *(http://coaps.fsu.edu/climate_center/tropicalweather.shtml)*. Based on data gathered from 1856 to 2008, Klotzbach and Gray (2009, p. 28) calculated the climatological and current-year probabilities for each State being impacted by a hurricane and major hurricane. Of the coastal States analyzed, Florida had the highest climatological probabilities, with a 51 percent probability of a hurricane and a 21 percent probability of a major hurricane over a 52-year time span. Florida had a 45 percent current-year probability of a hurricane and an 18 percent current-year probability of a major hurricane (Klotzbach and Gray 2009, p. 28). Given the Florida leafwing and Bartram's scrub-hairstreaks' low population sizes and few isolated occurrences within locations prone to storm influences, these butterflies are at substantial risk from hurricanes, storm surges, or other extreme weather. Depending on the location and intensity of a hurricane or other severe weather event, it is possible that the leafwing and hairstreak could become locally extirpated or extinct as a result of one event.

Other processes to be affected by climate change include temperatures, rainfall (amount, seasonal timing, and distribution), and storms (frequency and intensity). Temperatures are projected to rise from 2 °C to 5 °C (3.6 °F to 9 °F) for North America by the end of this century (IPCC 2007, pp. 7–9, 13). Based upon 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 to 30 percent decrease in hurricane frequency with a 5 to 10 percent wind increase. This is due to more hurricane energy available for intense hurricanes. However, hurricane frequency is expected to drop because more wind shear will impede initial hurricane development. 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 to 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 Florida leafwing and Bartram's scrub-hairstreak have adapted over time to the influence of tropical storms and other forms of adverse weather conditions (Minno and Emmel 1994, p. 671; Salvato and Salvato 2007, p. 154). However, given the substantial reduction in the historic range of these butterflies in the past 50 years, the threat and impact of tropical storms and hurricanes on their remaining populations is much greater than when their distribution was more widespread (Salvato and Salvato 2010a, p. 96; 2010b, p. 157; 2010c, p. 139).

During late October 2005, Hurricane Wilma caused substantial damage to the pine rocklands of northwestern Big Pine Key (Salvato and Salvato 2010c, p. 139), specifically within the Watson Hammock region of NKDR, the historic stronghold for the Florida leafwing on the island. In historical instances when leafwing and hairstreak population numbers were larger on Big Pine, such as following Hurricane Georges in 1998, these butterflies appeared able to recover soon after a storm (Salvato and Salvato 2010c, p. 139). In ENP, where leafwing and hairstreak densities remained stable, these butterflies were minimally affected by the 2005 hurricane season (Salvato and Salvato 2010a, p. 96, 2010b, p. 157). However, for the leafwing, given its substantial decline on Big Pine Key prior to Wilma, it is possible that the impact of this storm served to further hinder and reduce extant populations of the butterfly on the island (Salvato and Salvato 2010c, p. 139).

Environmental factors have likely impacted both butterflies and their habitat within their historical and current ranges. For example, unusually cold temperatures were encountered throughout southern Florida during the winters of 2009 and 2010. Sadle (pers. comm. 2009) noted frost damage on croton at ENP on Long Pine Key in late 2009, but observed living larvae earlier that year, when temperatures were at or barely above freezing (2.2 °C; 36 °F) and frost was on the ground. Frost in winter 2010 resulted in substantial dieback of native plants, including damage and widespread defoliation of the croton in Long Pine Key (Sadle, pers. comm. 2010; Land, pers. comm. 2010; Hallac *et al.* 2010, pp. 2–3). Fifty percent of the individual leafwing larvae were impacted by the cold and observed to be dead or without nearby food supplies within Long Pine Key (Hallac *et al.* 2010, p. 3). Although Salvato and Salvato (2011, p. 2) did not record increased butterfly larval mortality on their survey sites in ENP during early 2010, they did encounter larvae on frost-killed plants and indicated those larvae unable to successfully reach healthier adjacent hostplants likely perished.

During late 2010, Salvato and Salvato (2011, p. 2) noted increased larval leafwing mortality on their survey sites due to a number of factors, including cold. Sadle (pers. comm. 2011) also observed significant leaf and stem damage to croton during the same time period. A single dead leafwing larva was observed on a frost-damaged croton plant, though it is unclear if the mortality was a direct or indirect consequence of the freezing temperatures (Sadle, pers. comm. 2011). Salvato and Salvato (2011, p. 2) examined several (n = 4) dark, apparently frozen leafwing larvae during this time period, but later determined these had likely been killed from tachinid fly parasitism prior to the freeze. Sadle (pers. comm. 2011) and Salvato and Salvato (2011, p. 2) noted living larvae following the late 2010 freeze, largely in areas unaffected by the frost. From these observations, Sadle (pers. comm. 2011) suggested that frost damage may produce similar effects to loss of aboveground plant parts that results from fire. It is not clear what the short- or long-term impacts of prolonged cold periods may be on leafwing or hairstreak populations; however, it is likely that prolonged cold periods have some negative impacts on both the butterflies and their hostplant (Sadle, pers. comm. 2010; Land, pers. comm. 2010).

As described above (see *Factor C*), ongoing natural history studies by Salvato and Salvato (2012c, p. 1) indicate that the extant leafwing population within Long Pine Key experiences up to 80 percent mortality amongst immature larval stages. A similarly high mortality has been noted for the endangered Schaus swallowtail in southern Florida (Emmel 1997, p. 11). Such high levels of mortality may explain why leafwing population

densities vary considerably from year to year. As with the influence of tropical storms, population-level recoveries from high rates of parasitism or other factors at a select location would historically be offset from less-affected adjacent populations. Opportunities for such population-level recovery are now severely restricted (see ''Effects of Few, Small Populations and Isolation'' in this section).

Pesticides

Efforts to control mosquitoes and other insect pests have increased as human activity and population have increased in south Florida. To control mosquito populations, organophosphate (naled) and pyrethroid (permethrin) adulticides are applied by mosquito control districts throughout south Florida. In a rare case in upper Key Largo, another organophosphate (malathion) was applied in 2011 when the number of permethrin applications reached its annual limit. All three of 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 nontarget species, such as the Florida leafwing and Bartram's scrub-hairstreak.

The potential for mosquito control chemicals to drift into nontarget areas and persist for varying periods of time has been documented. 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 (*Papilio aristodemus ponceanus*),), as well as the Florida leafwing, Bartram's scrub-hairstreak, and other imperiled species in both the upper (Crocodile Lake NWR, North Key Largo) and lower Keys (NKDR). Residues of aerially applied naled were found 6 hours after application in a pineland area that was 750 meters (820 yards) from the target area; residues of fenthion (an adulticide no longer used in the Keys) applied via truck were found up to 50 meters (55 yards) 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 application in and around NKDR from 2007 to 2009. Permethrin, applied by truck, was found to drift considerable distances from target areas with residues that persisted for weeks. Naled, applied by plane, was also found to drift into nontarget areas but was much less persistent, exhibiting a half-life 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 (pers. comm. 2011) conducted two field trials on NKDR that detected significant naled residues at locations within nontarget areas on the Refuge that were up to 402 meters (440 yards) from the edge of zones targeted for aerial applications. After this discovery, the Florida Key Mosquito Control District recalibrated the on-board model (Wingman©). Naled deposition was reduced in some of the nontarget zones following recalibration (Bargar 2012b, p. 3).

In addition to mosquito control chemicals entering nontarget areas, the toxic effects of mosquito control 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 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 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 (pers. comm. 2011) observed cholinesterase activity depression, to a level shown to cause mortality in the laboratory, in great southern white and Gulf fritillary butterflies exposed to naled during an application on NKDR in both target and nontarget zones.

In the lower Keys, Salvato (2001, pp. 8–14) suggested that declines in populations of the Florida leafwing were also partly attributable to mosquito control chemical applications. Salvato (2001, p. 14; 2002, pp. 56–57) found relative populations of the Florida leafwing, when extant on Big Pine Key within NKDR, to increase during drier years when adulticide applications over the pinelands decreased, although Bartram's scrub-hairstreak did not follow this pattern. Salvato (2001, p. 14) suggested that butterflies, such as the leafwing, were particularly vulnerable to aerial applications based on their tendency to roost within the pineland canopy, an area with maximal exposure to aerial treatments. Because roosting sites for the Bartram's hairstreak are not well documented, more study is needed to assess their potential exposure. The role of vegetation in limiting exposure is unknown, but could be important when considering that spraying operations are conducted during early morning and late evening hours when, presumably, nontarget butterflies would be occupying roost sites (C. Anderson, pers. comm. 2013).

Toxicity data on Florida native butterflies exposed to permethrin and naled in the laboratory (Hoang *et al.* 2011, pp. 997–1005) were used to calculate hazard quotients (concentrations in the environment—concentrations causing an adverse effect) in order to assess the risk that concentrations of naled and permethrin found in the field pose to butterflies. A hazard quotient where the environmental concentration is greater than the concentration known to cause an adverse effect (mortality in this case), indicates significant risk to the organism. Environmental exposures for naled and permethrin were taken from Zhong *et al.* (2010, pp. 1961–1972) and Pierce (2009, pp. 1–17), respectively, and represent the highest concentrations of each chemical that were quantified during field studies in the Florida Keys. When using the lowest median lethal concentrations from the laboratory study, the hazard quotients for permethrin and naled indicated potential acute hazards to butterflies. Bargar (2012a, pp. 5–6) also conducted a probabilistic risk assessment using naled deposition values from NKDR and estimated that field-measured naled concentrations did pose a risk to adult butterflies of some species, particularly for species with large surface area to weight ratios.

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. It should be noted that many of the studies referenced above dealt with single application scenarios and examined effects on only one to 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 where 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).

Spraying practices by the Florida Keys Mosquito Control District (FKMCD) at NKDR have changed to reduce pesticide use over the years. In addition, larvicide treatments to surrounding islands have significantly reduced adulticide use on Big Pine Key, No Name Key, and the Torch Keys since 2003 (FKMCD 2012, p. 11). According to the Special Use Permit issued by the Service, the number of aerially applied naled treatments allowed on NKDR has been limited since 2008 (FKMCD 2012, pp. 10–11).

The Service's Integrated Pest Management (IPM) Policy (569 FW 1) establishes procedures and responsibilities for pest management activities on and off Service lands. These may include (1) Preparing pesticide use proposals (PUPs) for approval before applying pesticides; (2) entering pesticide usage information annually into the online IPM and Pesticide Use Proposal System (PUPS) database; (3) conducting Endangered Species Act consultations; and (4) following National Environmental Protection Act policies. Since these butterflies have been on the candidate list, the Service's South Florida Ecological Services Office and NKDR coordinate annually on potential impacts to the Florida leafwing and Bartram's scrub-hairstreak prior to issuance of a PUP to the FKMCD. Based on this consultation, 478 ha (1,180 ac) (705 ha (1,741 ac) of pine rockland) in the NKDR have been designated no-spray zones by agreement (as of May 2012) between the Service and FKMCD that includes the core habitat used by pine rockland butterflies (C. Anderson, pers. comm. 2012a; Service 2012, p. 32). In addition, several linear miles of pine rockland habitat within the Refuge-neighborhood interface were excluded from truck spray applications in the most sensitive habitats. These exclusions and buffer zones encompass over 95 percent of extant croton distribution on Big Pine Key, and include the majority of known extant and historical Florida leafwing and Bartram's scrub-hairstreak population centers on the island (Salvato, pers. comm. 2012). However, some areas of pine rocklands within NKDR are still sprayed with naled (aerially applied adulticide), and buffer zones remain at risk from drift; additionally, private residential areas and roadsides across Big Pine Key are treated with permethrin (ground-based applied adulticide) (Salvato 2001, p. 10). Therefore, the hairstreak and, if extant, the leafwing and their habitat on Big Pine Key may be directly or indirectly (via drift) exposed to adulticides used for mosquito control at some unknown level. Although there is evidence that mosquito control practices may influence butterfly species, limited information currently exists about population-level impacts. Actual impacts to the Florida leafwing and Bartram's scrub-hairstreak from mosquito control are unknown at this time; however, additional research is under way to quantify risk.

The Service will ensure compliance with our Pest Management Policy and the Act. We anticipate the need to expand existing buffer and no spray zones to include all hostplant-containing areas on the NKDR, as well as implement other measures (e.g., use more larvicides and less adulticides) to prevent adverse impacts to the butterflies and their habitat (on and off NKDR). Any changes to the pesticide application protocol will be closely coordinated with FKMCD. In addition, field monitoring may be required to demonstrate that application of pesticides in areas adjacent to Florida leafwing and Bartram's scrub-hairstreak habitat does not result in drift into the no spray zones, as has been documented in previous studies.

In general Long Pine Key in ENP does not appear to be regularly impacted by mosquito control practices, except for the use of adulticides (e.g., Sumithrin (Anvil)) in Park residential areas and campgrounds. Housing areas, maintenance areas, outside work areas for park maintenance staff and contractors, and areas near buildings have been sprayed in the past (Perry, pers. comm. 2007). Spraying occurred within ENP following hurricanes in 2005 (Perry, pers. comm. 2008). Subsequently, however, no spraying has been conducted in or near Long Pine Key. Populations of these butterflies occurring adjacent to and outside ENP in suitable and potential habitat within Miami-Dade County are also vulnerable to the lethal and sublethal effects of adulticide applications. However, mosquito control pesticide use within Miami-Dade County pine rockland areas is limited (approximately 2 to 4 times per year, and only within a portion of proposed critical habitat) (Vasquez, pers. comm. 2013)

In summary, although substantial progress has been made in reducing impacts, the potential effects of mosquito control applications and drift residues remain a threat to both butterflies.

Summary of Factor E

Based on our analysis of the best available information, we have identified several natural and manmade factors affecting the continued existence of the Florida leafwing and Bartram's scrub-hairstreak. Effects of small population size, isolation, and loss of genetic diversity are likely significant threats. Given the existing few populations and small size of the populations, environmental stochasticity may also contribute to imperilment. Other natural (e.g., changes to habitat) and anthropogenic factors (e.g., pesticides, fire, processes affected by climate change) are also identifiable threats.

Cumulative Effects of Threats Under Factor E

The limited distributions and small population sizes of the Florida leafwing and Bartram's scrub-hairstreak make them extremely susceptible to habitat loss, degradation, and modification and other anthropogenic threats. Mechanisms leading to the decline of the Florida leafwing and Bartram's scrub-hairstreak, as discussed above, range from local (e.g., a lack of adequate fire management, fragmentation, poaching), to regional (e.g., development, pesticides), to global influences (e.g., climate change, sea level rise). The synergistic (interaction of two or more components) effects of threats (such as hurricane effects on a species with a limited distribution consisting of just a few small populations) make it difficult to predict population viability. While these stressors may act in isolation, it is more probable that many stressors are acting simultaneously (or in combination) on Florida leafwing and Bartram's scrub-hairstreak populations.

Cumulative Effects: Factors A Through E

Florida Leafwing

The Florida leafwing has been extirpated (no longer in existence) from nearly 96 percent of its historical range; the only known extant population occurs within ENP in Miami-Dade County. Threats of habitat loss and fragmentation, including climatic change (*Factor A*), poaching (*Factor B*), parasitism, predation (*Factor C*), small population size, restricted range, and influence of chemical pesticides used for mosquito control (*Factor E*), still exist for the only remaining population.

Because there is only one small extant population of this butterfly, and limited law enforcement, collection has and continues to be a significant threat to this butterfly. Existing regulatory mechanisms (*Factor D*) are inadequate to protect this butterfly. The leafwing may be impacted when pine rocklands are converted to other uses or when lack of fire causes the conversion to habitats that are unsuitable for this butterfly. Because the remaining population is isolated and the butterfly has a limited ability to recolonize historically occupied habitats that are now highly fragmented, it is vulnerable to natural or human-caused changes in its habitats. As a result, impacts from increasing threats, singly or in combination, are likely to result in the extinction of the butterfly as there is no redundancy of populations.

Bartram's Scrub-Hairstreak

The Bartram's scrub-hairstreak has been extirpated from nearly 93 percent of its historical range; only five isolated metapopulations remain on Big Pine Key in Monroe County, Long Pine Key in ENP, and relict pine rocklands adjacent to the Park in Miami-Dade County. All 5 of these populations are, in part, on protected lands. Threats of habitat loss and fragmentation from lack of fire (*Factor A*), poaching (*Factor B*), disease, predation (*Factor C*), small population size, restricted range, influence of chemical pesticides used for mosquito control, and sea level rise (*Factor E*) still exist for the remaining populations. Because there are only five small populations of the hairstreak, and limited law enforcement, collection has and continues to be a significant threat to this butterfly. Existing regulatory mechanisms (*Factor D*) are inadequate to protect this butterfly from poaching. Because populations are isolated and the butterfly has a limited ability to recolonize historically occupied habitats that are now highly fragmented, it is vulnerable to natural or human-caused changes in its habitats. The remaining populations become less resilient and are not capable of recovering from the threats. As a result, impacts from increasing threats, singly or in combination, are likely to result in the extinction of the hairstreak.

Habitat loss, fragmentation, and degradation, and associated pressures from increased human population are major threats; these threats are expected to continue, placing these butterflies at greater risk. Although efforts are being made to conserve natural areas and apply prescribed fire, the long-term effects of large-scale and wide-ranging habitat modification, destruction, and curtailment will last into the future. Based on our analysis of the best available information, there is no evidence to suggest that vulnerability to collection and risks associated with scientific or conservation efforts will change and, instead, are likely to continue into the future. At this time, we consider predation, parasitism, and disease to be threats to both butterflies due to their current tenuous statuses. We have no information to suggest that vulnerability to these threats will change in the future. Based on our analysis of the best available information, we find that existing regulatory mechanisms, due to their inherent limitations and constraints, are inadequate to address threats to these butterflies throughout their ranges. We have no information to indicate that poaching, inconsistent fires, pesticide use, or habitat loss will be ameliorated in the future by enforcement of existing regulatory mechanisms.

Therefore, we find it reasonably likely that the effects on the Florida leafwing and Bartram's scrub-hairstreak will continue at current levels or potentially increase in the future. Effects of small population size, isolation, and loss of genetic diversity are likely significant threats as well as natural changes to habitat and anthropogenic factors (e.g., pesticides, fire, processes affected by climate change). Collectively, these threats have impacted the butterflies in the past, are impacting these butterflies now, and will continue to impact these butterflies in the future.

Determination

We have carefully assessed the best scientific and commercial information available regarding the past, present, and future threats to the Florida leafwing and Bartram's scrub-hairstreak butterflies. As described in detail above, both butterflies are currently at risk throughout all of their respective ranges due to the immediacy, severity, and scope of threats from habitat destruction and modification (*Factor A*), overutilization (*Factor B*), disease or predation (*Factor C*), inadequacy of existing regulatory mechanisms (*Factor D*), and other natural or manmade factors affecting their continued existence (*Factor E*). These stressors have had profound adverse effects on Florida leafwing and Bartram's scrub-hairstreak populations and the pine rockland habitat. As a result, impacts from increasing threats, singly or in combination, are likely to result in the extinction of these butterflies.

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 Florida leafwing butterfly is presently in danger of extinction throughout its entire range based on the severity and immediacy of threats currently impacting the subspecies. The overall range has been significantly reduced; the remaining habitat and population is threatened by a variety of factors acting in combination to reduce the overall viability of the subspecies. The risk of extinction is high because the remaining population is small, isolated, and the potential for recolonization is limited based on habitat loss and fragmentation, mosquito control, poaching, parasitism, predation, and climatic change.

The Florida leafwing and Bartram's scrub-hairstreak butterflies are highly restricted in their ranges and threats occur throughout their ranges. Therefore, we assessed the status of the species throughout their entire ranges. The threats to the survival of the species occur throughout the species' ranges and are not restricted to any particular significant portion of those ranges. Accordingly, our assessment and proposed determination applies to both the species throughout their entire ranges.

Therefore, on the basis of the best available scientific and commercial information, we propose listing the Bartram's scrub-hairstreak butterfly 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 Bartram's scrub-hairstreak butterfly because of the severity and immediacy of the threats, its restricted range (93 percent loss), threats are occurring rangewide and are not localized, its five small populations, and because the threats are ongoing and expected to continue into the future.

Available Conservation Measures

Conservation measures provided to species listed as endangered or threatened under the Act include recognition, recovery actions, requirements for Federal protection, and prohibitions against certain practices. Recognition through listing results in public awareness and conservation by Federal, State, Tribal, and local agencies; private organizations; and individuals. The Act encourages cooperation with the States and 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 (comprising 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 Field Office (see **FOR FURTHER INFORMATION CONTACT**).

Implementation of recovery actions generally requires the participation of a broad range of partners, including other Federal agencies, States, Tribes, nongovernmental organizations, businesses, and private landowners. Examples of recovery actions include habitat restoration (e.g., restoration of native vegetation), research, captive propagation and reintroduction, and outreach and education. The recovery of many listed species cannot be accomplished solely on Federal lands because their range may occur primarily or solely on non-Federal lands. To achieve recovery of these species requires cooperative conservation efforts on private, State, and Tribal lands.

If these butterflies are listed, funding for recovery actions will be available from a variety of sources, including Federal budgets, State programs, and cost-share grants for non-Federal landowners, the academic community, and nongovernmental organizations. In addition, under section 6 of the Act, the State of Florida would be eligible for Federal funds to implement management actions that promote the protection and recovery of Florida leafwing and Bartram's scrub-hairstreak butterflies. Information on our grant programs that are available to aid species recovery can be found at: *http://www.fws.gov/grants.*

Although Florida leafwing and Bartram's scrub-hairstreak are only proposed for listing under the Act at this time, please let us know if you are interested in participating in recovery efforts for these butterflies. Additionally, we invite you to submit any new information on these butterflies whenever it becomes available and any information you may have for recovery planning purposes (see **FOR FURTHER INFORMATION CONTACT**).

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

Federal agency actions within these butterflies' 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 Department of Defense, National Park Service, and U.S. Fish and Wildlife Service; construction and maintenance of roads or highways by the Federal Highway Administration; flood insurance and disaster relief efforts conducted by the Federal Emergency Management Agency; and pesticide treatments required by the U.S. Department of Agriculture or Florida Department of Agriculture and Consumer Services in the event of emergency pest outbreak.

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

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

The Service acknowledges that it cannot fully address some of the natural threats facing the Florida leafwing and Bartram's scrub-hairstreak (e.g., hurricanes, tropical storms) or even some of the other significant, long-term threats (e.g., climatic changes, sea level rise). However, through listing, we provide protection to the known population(s) and any new population of these butterflies that may be discovered (see section 9 of Available Conservation Measures below). With listing, we can also influence Federal actions that may potentially impact these butterflies (see section 7 below); this is especially valuable if they are found at additional locations. With this action, we are also better able to deter illicit collection and trade.

Our policy, as published in the **Federal Register** on July 1, 1994 (59 FR 34272), is to identify to the maximum extent practicable at the time a species is listed, those activities that would or would not constitute a violation of section 9 of the Act. The intent of this policy is to increase public awareness of the effect of a proposed listing on proposed and ongoing activities within the range of species proposed for listing. We estimate that the following activities would be likely to result in a violation of section 9 of the Act; however, possible violations are not limited to these actions alone:

(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, of the Florida leafwing or Bartram's scrub-hairstreak butterflies (research activities where the Florida leafwing or Bartram's scrub-hairstreak are handled, captured (e.g., netted, trapped), marked, or collected will require authorization pursuant to the Act).

(2) Incidental take of the Florida leafwing or Bartram's scrub-hairstreak without authorization pursuant to section 7 or section 10(a)(1)(B) of the Act.

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

(4) Unauthorized destruction or alteration of the Florida leafwing or Bartram's scrub-hairstreak habitat (including unauthorized grading, leveling, plowing, mowing, burning, herbicide spraying, or pesticide application) in ways that kills or injures individuals by significantly impairing these butterflies' essential breeding, foraging, sheltering, or other essential life functions.

(5) Unauthorized use of pesticides or herbicides resulting in take of the Florida leafwing or Bartram's scrub-hairstreak butterflies.

(6) Unauthorized release of biological control agents that attack any life stages of these taxa.

(7) Unauthorized removal or destruction of pineland croton, the hostplant utilized by the Florida leafwing or Bartram's scrub-hairstreak butterflies, within areas used by the butterflies that result in harm to the butterflies.

(8) Release of nonnative species into occupied Florida leafwing and Bartram's scrub-hairstreak habitat that may displace the butterflies or their native host plants.

Questions regarding whether specific activities would constitute a violation of section 9 of the Act should be directed to the Field Supervisor of the Service's South Florida Ecological Services Office (see **FOR FURTHER INFORMATION CONTACT**). Requests for copies of regulations regarding listed species and inquiries about prohibitions and permits should be addressed to the U.S. Fish and Wildlife Service, Ecological Services Division, Endangered Species Permits, 1875 Century Boulevard, Atlanta, GA 30345 (Phone 404–679–7140; Fax 404–679–7081).

Peer Review

In accordance with our joint policy on peer review published in the **Federal Register** on July 1, 1994 (59 FR 34270), we will seek the expert opinions of at least three appropriate and independent specialists regarding this proposed rule. The purpose of peer review is to ensure that our listing designation is based on scientifically sound data, assumptions, and analyses. We have invited these peer reviewers to comment during this public comment period.

We will consider all comments and information received during this comment period on this proposed rule during our preparation of a final determination. Accordingly, the final decision may differ from this proposal.

Public Hearings

Section 4(b)(5) of the Act provides for one or more public hearings on this proposal, if requested. Requests must be received within 45 days after the date of publication of this proposed rule in the **Federal Register**. Such requests must be sent to the address shown in **FOR FURTHER INFORMATION CONTACT**. We will schedule public hearings on this proposal, if any are requested, and announce the dates, times, and places of those hearings, as well as how to obtain reasonable accommodations, in the **Federal Register** and local newspapers at least 15 days before the hearing.

Required Determinations

Clarity of the Rule

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

(1) Be logically organized;

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

(3) Use clear language rather than jargon;

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

(5) Use lists and tables wherever possible.

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

National Environmental Policy Act (NEPA)

We have determined that environmental assessments and environmental impact statements, as defined under the authority of the National Environmental Policy Act of 1969 (42 U.S.C. 4321 *et seq.*), need not be prepared in connection with listing a species as an endangered or threatened species under the Endangered Species Act. We published a notice outlining our reasons for this determination in the **Federal Register** on October 25, 1983 (48 FR 49244).

References Cited

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

Authors

The primary authors of this proposed rule are the staff members of the South Florida Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**).

List of Subjects in 50 CFR Part 17

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

Proposed Regulation Promulgation

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

PART 17—[AMENDED]

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

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

■ 2. In § 17.11(h) add new entries for ''Butterfly, Bartram's scrub-hairstreak'' and ''Butterfly, Florida leafwing'' to the List of Endangered and Threatened

Wildlife in alphabetical order under Insects to read as set forth below:

§ 17.11 Endangered and threatened wildlife.

(h) * * *

* * * * *

Species		Historic range	Vertebrate population where endanged or threatened	Status	Family	When listed	Critical habitat	Special rules
Common name	Scientific name							
*	*	*	*	*	*	*	*	
INSECTS								
*	*	*	*	*	*	*	*	
Butterfly, Bartram's scrub-hairstreak.	*Strymon acis bartrami*.	U.S.A. (FL)	Entire	E	Lycaenidae	.....	.....	NA
*	*	*	*	*	*	*	*	
Butterfly, Florida leafwing.	*Anaea troglodyta floridalis*.	U.S.A. (FL)	Entire	E	Nymphalidae ...	.....	.....	NA
*	*	*	*	*	*	*	*	

Dated: August 2, 2013.

Rowan W. Gould,

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

[FR Doc. 2013–19794 Filed 8–14–13; 8:45 am]

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