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50 CFR Part 17

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

**DEPARTMENT OF THE INTERIOR**

**Fish and Wildlife Service**

**50 CFR Part 17**

**[Docket No. FWS–R4–ES–2013–0084; 4500030113]**

**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:** Final rule.

**SUMMARY:** We, the U.S. Fish and Wildlife Service, determine endangered species status under the Endangered Species Act of 1973, as amended, for the Florida leafwing (*Anaea troglodyta floridalis*) and Bartram's scrub-hairstreak (*Strymon acis bartrami*), two butterflies endemic to South Florida. This final rule implements the protections provided by the Act for these species. This regulation will result in the addition of these species to the List of Endangered and Threatened Wildlife.

**DATES:** This rule becomes effective September 11, 2014.

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

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

**SUPPLEMENTARY INFORMATION:**

## Executive Summary

*Why we need to publish a rule.* Under the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (Act), a species may warrant protection through listing if we find that it is an endangered or threatened species throughout all or a significant portion of its range. Listing a species as endangered or threatened can only be completed by issuing a rule. Elsewhere in today's **Federal Register**, we designate critical habitat for the Florida leafwing butterfly and the Bartram's scrub-hairstreak butterfly under the Act.

*This rule will* finalize the listing of the Florida leafwing butterfly and the Bartram's scrub-hairstreak butterfly as endangered species.

*The basis for our action.* Under the Act, the U.S. Fish and Wildlife Service (Service) 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 Florida leafwing and Bartram's scrub-hairstreak butterflies meet the definition of an endangered species based on all five factors.

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

## Previous Federal Actions

Please refer to the proposed listing rule for the Florida leafwing and Bartram's scrub-hairstreak butterflies (78 FR 49878; August 15, 2013) for a detailed description of previous Federal actions concerning these species.

## Summary of Comments and Recommendations

In the proposed rule published on August 15, 2013 (78 FR 49878), we requested that all interested parties submit written comments on the proposal by October 15, 2013. We also contacted appropriate Federal and State agencies, scientific experts, and organizations, and other interested parties and invited them to comment on the proposal. Newspaper notices inviting general public comment were published in the Miami Herald and Key West Citizen.

We published proposed rules concurrently for both the proposed listing of the Florida leafwing and Bartram's scrub-hairstreak, as well as the proposed designation of critical habitat for these two butterflies. Although the proposed rules were published in separate **Federal Register** notices, we received combined comments from the public on both actions. However, in this final rule we address only those comments that apply to the listing of the Florida leafwing and Bartram's scrub-hairstreak. Comments on the proposed critical habitat are addressed in the final critical habitat rule. All substantive information provided during the comment period has either been incorporated directly into this final determination or addressed below.

### *Peer Reviewer Comments*

In accordance with our peer review policy published on July 1, 1994 (59 FR 34270), we solicited expert opinions from eight knowledgeable individuals with scientific expertise that included familiarity with at least one of the two subspecies and its habitat, biological needs, and threats; the geographical region of South Florida in which these subspecies occur; and conservation biology principles. We received responses from seven of the peer reviewers we contacted.

We reviewed all comments we received from the peer reviewers for substantive issues and new information regarding the proposed listing of the Florida leafwing and Bartram's scrub-hairstreak butterflies. The peer reviewers generally concurred with our methods and conclusions, and provided additional information, clarifications, and suggestions to improve the final listing rule. Peer reviewer comments are addressed in the following summary and incorporated into this final rule as appropriate.

(1) *Comment:* One peer reviewer, as well as two public commenters, indicated that developing appropriate monitoring schemes to understand population biology, dynamics, dispersal abilities and various environmental variables will be critical to advancing recovery goals.

*Our Response:* We agree that more rigorous information regarding population monitoring, ecological studies, and other ongoing or future research and recovery efforts for the Florida leafwing and Bartram's scrub-hairstreak are needed, and we have updated the *Population Estimates and Status* sections, below.

(2) *Comment:* Two peer reviewers indicated the importance of disturbance

regimes, such as fire, to achieving conservation goals for these subspecies, and that active adaptive management should be implemented.

*Our Response:* We incorporated new information regarding fire management plans, as well as ongoing and future studies designed to measure the influence of prescribed burns and other management actions (such as mechanical clearing), into the *Factor A* discussion, below.

(3) *Comment:* One peer reviewer mentioned the importance of smaller parcels for conservation. The reviewer also asked for clarification regarding the amount of remaining pine rockland habitat.

*Our Response:* We agree that even small parcels of extant pine rocklands have important conservation value to imperiled butterflies. One of the analyses we cite in this rule (Institute for Regional Conservation 2006) pertained only to pineland croton occurrence on parcels greater than a single hectare. However, all extant pine rockland, with or without hostplant populations, were reviewed, both for the proposed listing rule and the proposed rule to designate critical habitat. The reference to 1,780 hectares (ha) (4,400 acres (ac)) of remaining pine rockland habitat refers only to 375 parcels of extant pine rockland within Miami-Dade County, outside of Everglades National Park (ENP). We have revised the information on extant pine rockland habitat and known hostplant distribution under the *Habitat* section, below.

(4) *Comment:* One peer reviewer provided a link to research findings on the potential impact of sea-level rise on south Florida butterflies.

*Our Response:* We incorporated this new information into the *Factor A* discussion, below.

(5) *Comment:* One peer reviewer indicated that, based on the threat of habitat loss from climate change, development, and other factors, it may be important to consider appropriate habitat at the fringes of the subspecies' historical ranges (Martin and Palm Beach Counties) in conservation planning.

*Our Response:* Although the Florida leafwing and Bartram's hairstreak are only known to have occurred sporadically outside of Monroe and Miami-Dade Counties, Florida, future recovery actions may include efforts within the more northern parts of their historical ranges that retain hostplant populations. We incorporated information regarding this potential recovery option into the *Factor A* discussion, below.

(6) *Comment:* One peer reviewer indicated that pineland croton (*Croton linearis*) has sometimes been referred to by the common name of woolly croton. In addition, *C. linearis* and *C. cascarilla* are synonymous in the literature.

*Our Response:* We incorporated this new information into the *General Biology* section of the Florida leafwing.

(7) *Comment:* One peer reviewer indicated that the high level of parasitism on immature Florida leafwing is not something that can be controlled. As a result, recovery efforts should focus on the adult stages.

*Our Response:* We agree and have incorporated this new information into the *Factor C* discussion, below.

(8) *Comment:* One peer reviewer provided a correction indicating that the Florida leafwing had not been included throughout the *Determination* section of the proposed rule.

*Our Response:* We have incorporated the Florida leafwing throughout the *Determination* section of the final rule, below.

(9) *Comment:* One peer reviewer indicated that existing evidence supports the recognition of *floridalis* as a subspecies of *Anaea troglodyta* and referenced several articles in the literature.

*Our Response:* We appreciate the information provided and have incorporated it into the *Taxonomy* section for the Florida leafwing.

(10) *Comment:* One peer reviewer provided additional references in the literature pertaining to life histories of the Florida leafwing and Bartram's scrub-hairstreak. This reviewer also provided additional references pertaining to the historical ranges of the butterflies.

*Our Response:* We appreciate the information provided and have incorporated it into the *Life History* and *Historical Ranges* sections for the Florida leafwing and Bartram's scrub-hairstreak.

(11) *Comment:* One peer reviewer indicated that the rarity of the Florida leafwing and Bartram's scrub-hairstreak and difficulty in collecting the leafwing, in particular, makes it unlikely that collecting could impact the population.

*Our Response:* We appreciate the information; however, based on the small localized nature of extant Florida leafwing and Bartram's scrub-hairstreak populations, any removal of individuals at this time may have an adverse impact to those populations. Based on information on collecting pressures, small population sizes, and limited law enforcement targeting butterfly collection, outlined in the proposed rule and in our decision record, we believe there is sound scientific information to conclude that collection poses a threat to these butterflies.

(12) *Comment:* One peer reviewer suggests that many specimens of the Florida leafwing and Bartram's scrub-hairstreak offered for sale online may come from older collections, as opposed to poaching activities on conservation lands.

*Our Response:* We appreciate the information provided and have incorporated it into the *Factor C* discussion, below.

(13) *Comment:* Two peer reviewers support the proposed listing of the Florida leafwing and Bartram's scrub-hairstreak as endangered, but are skeptical as to what would be done to recover them. These reviewers indicate recovery efforts have not been successful for the endangered Schaus swallowtail or Miami blue butterflies and wonder what would be done differently for the proposed butterflies, if listed.

*Our Response:* In accordance with section 4(f)(1) of the Act, we are required to develop and implement a recovery plan for any species listed as endangered or threatened under the Act unless ''such a plan will not promote the conservation of the species.'' We believe a recovery plan will promote the conservation of these species and would address many of the factors outlined in the Summary of Factors Affecting the Species, below.

(14) *Comment:* One peer reviewer suggested the phrase ''Collection, which is prohibited on conservation lands, could occur (e.g., ENP, National Key Deer Refuge [NKDR], State or County owned lands) without being detected, because these areas are all not actively patrolled . . .'' could attract poachers to these areas.

*Our Response:* We appreciate the information provided, but feel the language, as written, emphasizes the threat of collection and where additional conservation actions may be warranted.

(15) *Comment:* One peer reviewer indicates that, while he agrees that mark-release-recapture techniques may be harmful to small lycaenids, it is important to emphasize the potential downsides of not using such a technique, namely possible recounting, etc.

*Our Response:* We appreciate the information provided and have incorporated it into the *Factor B* discussion, below.

(16) *Comment:* One peer reviewer indicates that research on symbiosis between lycaenids and ants for the Miami blue should be included for the

immature stages of the Bartram's scrub-hairstreak.

*Our Response:* Although a symbiotic relationship between Bartram's scrub-hairstreak larvae and ants has not been documented, we appreciate the information provided and have incorporated it into the *Factor C* discussion for the hairstreak, below.

(17) *Comment:* One peer reviewer indicates that adult Bartram's scrub-hairstreak have been observed within Zoo Miami in recent years and that it should be mentioned within the summary of known extant population.

*Our Response:* We appreciate the information provided and have incorporated it into the *Current Range* section of the Bartram's scrub-hairstreak.

(18) *Comment:* One peer reviewer indicated that existing data do not support the necessity of indicating a specified return interval for disturbance (i.e., 3 to 5 years for fire) for Long Pine Key. The commenter indicated that the butterflies have been observed at varying densities within pine rocklands in Long Pine Key that have burned at intervals of up to 10 years.

*Our Response:* We agree that, while the literature (Florida Natural Areas Inventory (FNAI) 2010a, p. 3) indicates a fire-return interval of approximately 3 to 7 years is appropriate for maintaining the pine rockland ecosystem, there is considerable variability in population numbers of the Florida leafwing and Bartram's scrub-hairstreak from year to year. Observations of the Florida leafwing and Bartram's scrub-hairstreak within portions of Long Pine Key that have experienced fire or other disturbance regimes at intervals of up to 10 years (Salvato and Salvato 2010a, p. 91; 2010b, p. 154; Sadle 2013c, pers. comm.) suggest further studies are required on the influence of these factors on butterfly ecologies. We appreciate the information provided and have incorporated it into the *Factor A* discussion, below.

(19) *Comment:* One peer reviewer, as well as one public comment, indicated that it may not be accurate to call Bartram's scrub-hairstreak a sedentary butterfly.

*Our Response:* We agree that, although the Bartram's scrub-hairstreak is often described as sedentary, the need to evade natural disturbance (fires, storms) and subsequently recolonize suggests that adult hairstreaks, perhaps as a function of age, sex, or density, are adapted for effective dispersal throughout the pine rockland and associated ecosystems. We appreciate the information provided and have incorporated it into the *Life History* discussion for the hairstreak, below.

(20) *Comment:* One peer reviewer indicated that an additional habitat, hydric pine flatwoods, is often used during dispersal by the Florida leafwing and Bartram's scrub-hairstreak, when it is adjacent or interspersed within pine rocklands.

*Our Response:* We appreciate the information provided and have included a description of hydric pine flatwoods in the *Habitat* section, below.

*Comments From States*

Section 4(b)(5)(A)(ii) of the Act requires the Secretary, not less than 90 days before publication of a final listing rule, to give actual notice of the rule to the State agency in each State in which the species is believed to occur, and invite the comment of such agency on the proposal. The two subspecies only occur in Florida, and we received comment letters from two entities from the State of Florida regarding the listing proposal. The Florida Fish and Wildlife Conservation Commission (FWC) found the document to be comprehensive, with conclusions that are well-documented and justified, but otherwise did not provide substantive comments requiring a response. The Florida Department of Agriculture and Consumer Services (FDACS) neither supported nor opposed the proposed listing, but indicated their intent to work with the Service and other stakeholders in protecting imperiled species, as well as determining ways to mitigate potential risks of pesticide use and mosquito control toward imperiled species in Florida.

(21) *Comment:* FDACS indicated that, given the current mosquito control district cooperation, any future considerations concerning research addressing potential for and magnitude of impact of mosquito control practices on imperiled butterflies, including the Florida leafwing and Bartram's hairstreak, should continue to be discussed in this forum where mosquito control districts can actively participate.

*Our Response:* We agree and appreciate the mosquito control districts' cooperation and willingness to help support and direct research to minimize potential pesticide impacts on imperiled butterflies.

*Public Comments*

During the comment period for the proposed listing rule, we received a total of 18 comment letters regarding the proposed listing: 2 from Florida State agencies (addressed above) and 16 from local governments, nongovernmental organizations, and private citizens. Of the 16 non-State letters, 12 indicated support of the proposed listing, but otherwise did not provide specific comments on the rule. Four of the comment letters provided substantive comments regarding two general issues. We did not receive any requests for a public hearing.

Issue 1: Mosquito Control

(22) *Comment:* One commenter questioned the inclusion of mosquito control activities as a factor affecting the species and suggested that habitat loss is the primary factor impacting the butterflies. The commenter also stated that ''it is reasonable and prudent to coordinate control measures to minimize risk in the remaining limited habitat areas'' and that ''protecting and preserving the species habitat through acquisition seems to be the most reasonable means of preserving the species.''

*Our Response:* We agree that habitat loss has been a major factor leading to the current status of the Florida leafwing and Bartram's scrub-hairstreak. However, as discussed in *Factor E—Other Natural or Manmade Factors Affecting Its Continued Existence,* below, we believe mosquito control activities are also a factor affecting these butterflies. We agree that protecting and preserving remaining habitat will be critical in the conservation and recovery of the butterflies and that mosquito control efforts should be coordinated between the Service and mosquito control districts in areas where suitable or occupied habitats exist.

(23) *Comment:* Three counties (Lee, Manatee, and Lake) and another commenter recommended that mosquito control activities not be included as a factor affecting the species. The commenters state that this inclusion would lead to restrictions on mosquito control operations that would be detrimental to public health and the economy of south Florida.

*Our Response:* The use of broad spectrum insecticides in and around Florida leafwing and Bartram's scrub-hairstreak habitat during mosquito control operations is a factor that must be considered when assessing threats to the species. The Act requires us to base our determination for listing a species ''solely on the basis of the best scientific and commercial data available'' (section 4(b)(1)(A)). The Service has worked proactively in the past with mosquito control districts within habitat of the endangered Schaus' swallowtail (*Papilio aristodemus ponceanus*) (Hennessey *et al.* 1992, p. 715; Salvato 2001, p. 8) in order to coordinate mosquito control activities in such a way that public

health is adequately protected while still promoting conservation and recovery of the species. As a result, we believe similar cooperation between the Service and mosquito control districts will occur in suitable or occupied habitat of the Florida leafwing and Bartram's scrub-hairstreak. Under public health emergency conditions, the Service would not impose restrictions that would jeopardize the safety or well-being of the public.

(24) *Comment:* Lee County contends that Salvato's (2001) suggestion that butterflies roosting in the canopy would be vulnerable to aerial mosquito control spray is incorrect, and that roosting under leaves would actually provide protection to the butterflies. Lee and Manatee Counties also state that using caged, nontarget insects to examine pesticide effects in the field following application events is not realistic and has a high level of bias in favor of an adverse effect. Specifically, Lee County mentions the work of Zhong *et al.* (2010) where larval and adult butterflies were exposed without the ability to seek refuge after dark, while Manatee County mentions the work of Bargar (2011) where caged species were placed in open field areas.

*Our Response:* The Service agrees that refugia, including vegetation, may help to ameliorate pesticide effects on some field-exposed organisms. The extent to which such refugia may protect against pesticide exposure is unknown. However, with no data to support the assertion that vegetative refugia prevents impacts to butterflies from mosquito control application, the Service must rely on the best available data, which suggests that impacts to butterflies are a possibility.

(25) *Comment:* Lee County states that the risk assessment presented in Hoang *et al.* (2011) inappropriately uses the residue data from Pierce (2009). The commenter contends that pesticide residues quantified on surfaces in the environment would not be equivalent to residues on cryptic insects and that Hoang *et al.* (2011) assigns risk without considering actual insect contact with pesticides in the field.

*Our Response:* The Service considers the risk analysis presented in Hoang *et al.* (2011, pp. 997–1005) to be a screening-level evaluation that examined worst-case scenarios, evidenced by the fact that the highest quantified deposition values from Pierce (2009, pp. 1–20) were used to determine risk. Actual insect exposures may vary from the deposition observed on leaves and filter pads, but no relevant field-derived insect pesticide body load analysis has been conducted. With no supporting data to the contrary, the Service cannot assume insect exposure values are below a level of concern.

(26) *Comment:* Lee County states that the Environmental Protection Agency (EPA) labels pesticides for uses that do not pose unacceptable risk to individuals and the environment and that ''the EPA has successfully assessed the risk for mosquito control practices since no connection between pesticide residues and insect mortality outside of target zone is cited'' by the Service. Manatee County also states that the EPA's registration of aerial adulticides implies that the EPA has determined that this practice does not harm butterfly populations.

*Our Response:* The Service acknowledges that more information is needed to better quantify the drift, and subsequent effects, of mosquito control chemicals outside of target zones. Registration of a pesticide by the EPA does not imply that there are no nontarget species potentially at risk from label-approved uses. When registering pesticides, the EPA does not conduct exhaustive testing on terrestrial invertebrates. Honeybees are the only species subject to acute toxicity testing. The results of such testing using naled and permethrin determined that both pesticides are highly toxic to honeybees (EPA 2006a, p. 32; EPA 2006b, p. 81). Impacts of pesticides on butterfly species are not currently considered during EPA's registration process.

(27) *Comment:* Manatee County states that the Service failed to report that naled application rates were higher than expected due to inaccurate GPS-guided flight patterns during the Zhong *et al.* (2010) study, where a 73.9 percent survival rate of Miami blue butterfly larvae was observed. The reviewer also states that Zhong had conducted previous research on the same topic that showed no effects of aerial naled application on Miami blue butterfly larvae.

*Our Response:* The data cited from Zhong *et al.* (2010, pp. 1967–1970) came from a peer-reviewed journal article. No mention was made in the journal article of any GPS-related impacts on the results of the study; therefore, the Service has no such information to report. The Service is also not aware of any additional work by Zhong that examined naled impacts on the Miami blue butterfly, but would welcome any such information.

(28) *Comment:* Manatee County suggests that mosquito control spraying may be beneficial to butterfly populations. The County references the work of Marc Minno, a lepidopterist who has conducted butterfly population assessments in south Florida and has documented significant butterfly populations in areas such as Miami and Key West that receive mosquito control applications.

*Our Response:* The Service is open to considering all potential aspects of the interaction between mosquito control practices and the success of the Florida leafwing and Bartram's scrub-hairstreak. In-depth analysis, beyond anecdotal observations of various species, would be required to support the assertion that mosquito control practices are beneficial to any species of interest.

(29) *Comment:* Lake County states that, if the two butterfly species of interest are imperiled because of mosquito control practices, then all other nontarget organisms with similar habitat needs and behaviors would be in jeopardy. The reviewer also states that no impacts on butterfly populations have occurred in Lake County despite more than 32 years of mosquito control activity.

*Our Response:* The Service believes that the individual life histories of the butterfly species of interest, and their susceptibilities to pesticide impacts, must be considered independently, and that the status of other nontarget organisms cannot be used as a surrogate during such consideration. The Service is also not aware of any comprehensive assessment on the population status of butterflies in Lake County, but would welcome such information.

(30) *Comment:* Lee County indicates that the Florida leafwing and Bartram's scrub-hairstreak butterflies continue to exist in areas that meet their environmental requirements, including those that have been sprayed for 40 years.

*Our Response:* We agree that these butterflies have retained populations in appropriate extant pine rockland habitat within Monroe and Miami-Dade, including within areas actively treated with mosquito control pesticides. However, we present evidence under the *Factor E* discussion, below, that suggests pesticide application administered for mosquito control may also have a collateral influence on the ecologies of the Florida leafwing and Bartram's scrub-hairstreak. On the other hand, at no point in the proposed or final listing rules is the role of pesticide application considered as the sole contributor to the decline in populations of these taxa, but merely one potential factor. The purpose of the Summary of Factors Affecting the Species section indicates all known or suspected factors, biological or anthropogenic, and this does include pesticide applications.

Issue 2: Population Dynamics

(31) *Comment:* One commenter indicates that pineland croton may not be the only larval hostplant used by the Bartram's scrub-hairstreak. The commenter indicates other scrub-hairstreaks are generally known to use a variety of larval hostplants, and that more field observation might reveal additional hostplants for the Bartram's scrub-hairstreak.

*Our Response:* Extensive field studies have been conducted on the Bartram's scrub-hairstreak over the past several decades; to date this research has documented oviposition only on pineland croton. However, we agree that ongoing ecological studies may indicate the hairstreak occasionally uses other pine rockland plants for larval development. We appreciate the information provided and have incorporated it into the *General Biology* discussion for the hairstreak, below.

(32) *Comment:* Lee County indicates that the Florida leafwing shows annual mortality of up to 70 percent based on increased predation from exotic and native predators or parasites.

*Our Response:* There are a number of factors which influence the populations of the Florida leafwing and Bartram's scrub-hairstreak. However, the mortality mentioned by this reviewer is part of the Florida leafwing's natural history. We have no evidence that natural mortality, from predation or parasitism, of Florida leafwing populations within the Long Pine Key portion of ENP is any different now than it was historically.

(33) *Comment:* Lee County indicates that lack of burning on public lands by the Service and its partners is correlated with the loss of habitat for the Florida leafwing and Bartram's scrub-hairstreak. In addition, these butterflies have shown increased population numbers in response to an appropriate fire-return interval.

*Our Response:* As discussed in the previous comment, we agree that a number of factors influence the populations of the Florida leafwing and Bartram's scrub-hairstreak; this includes a lack of adequate fire management within the pine rocklands on conservation lands.

(34) *Comment:* Lee County indicates that the Service desires to expand the present range of the Florida leafwing and Bartram's scrub-hairstreak to elsewhere in their historical ranges.

*Our Response:* We have proposed the listing of the Florida leafwing and Bartram's scrub-hairstreak as endangered, as a first of many steps designed to recover these butterflies. Implementing conservation measures for populations of these butterflies within their extant or recent historical distributions will be a primary goal of the recovery plan, when drafted.

**Summary of Changes From Proposed Rule**

In the Background section, we made the following changes:

(1) We incorporated new information regarding population monitoring, ecological studies, and other ongoing or future research and recovery efforts for the Florida leafwing and Bartram's scrub-hairstreak.

(2) We clarified our discussion on extant pine rockland habitat, including smaller parcels, and known hostplant distribution.

(3) We indicated throughout the document that adult butterflies will also make use of hydric pine flatwood vegetation when interspersed within the pine rockland habitat.

(4) We included a full description of the hydric pine flatwoods forest community.

(5) We indicated that additional studies are needed to understand varying butterfly densities in response to pine rockland fire-return intervals.

(6) We included additional information on the scientific and common names of pineland croton.

(7) We included additional references that recognize *floridalis* as a subspecies of *Anaea troglodyte.*

(8) We included additional references on the life histories of the Florida leafwing and Bartram's scrub-hairstreak.

(9) We included additional references on the historical ranges of the Florida leafwing and Bartram's scrub-hairstreak.

(10) We incorporated additional information on the current range of the Bartram's scrub-hairstreak.

(11) We included additional information on larval hostplants used by the Bartram's scrub-hairstreak.

(12) We included additional information regarding Bartram's scrub-hairstreak dispersal abilities.

In the Summary of Factors Affecting the Species section, we made the following changes:

(1) We incorporated new information regarding fire management plans, as well as ongoing and future studies designed to measure the influence of prescribed burns and other management actions (such as mechanical clearing).

(2) We included new information on the potential impact of sea-level rise on south Florida butterflies.

(3) We incorporated information regarding potential recovery options based on the threat of habitat loss from climate change, development, and other factors.

(4) We added that it may be important to consider appropriate habitat at the fringes of the subspecies' historical ranges.

(5) We included the Florida leafwing in the Determination section.

(6) We included additional information regarding the potential provenance of butterfly specimens offered for sale online.

(7) We corrected the title of the Imperiled Butterflies of Florida Workgroup.

(8) We corrected the title of CERP to read as the Comprehensive Everglades Restoration Plan.

(9) We incorporated information to emphasize the potential downsides of not using mark-release-recapture techniques for butterfly monitoring.

(10) We incorporated information on symbiosis between lycaenids and ants under the discussion of Bartram's scrub-hairstreak predation.

**Background**

Please refer to the proposed listing rule for the Florida leafwing and Bartram's scrub-hairstreak butterflies (78 FR 49878; August 15, 2013) for species information. The sections below represent summaries of that information, and incorporate additions and edits based on peer review and public comments.

*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 South Florida 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 Florida leafwing has only one known hostplant, the pineland croton (or woolly croton) (*Croton linearis,* formerly referred to as *C. cascarilla*) (Euphorbiaceae).

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. Calhoun (1997, p. 47), Opler and Warren (2003, p. 40), Lamas (2004, p. 225) 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) and indicates that this subspecies' taxonomic standing is valid. The 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 (Matteson 1930, pp. 1–9; 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 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 immature stages of this butterfly feed on pineland croton for larval development. 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, Minno *et al.* 2005, p. 115). 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.

*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 characteristic of the genus (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) (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). However, other related scrub-hairstreak species, such as the Martial scrub-hairstreak (*Strymon martialis*), while having preference for bay cedar as a larval hostplant, have recently been documented using nickerbean (*Caesalpinia spp.)* in the Florida Keys (Daniels *et al.* 2005, pp. 174–175). Similarly, the mallow scrub-hairstreak (*Strymon istapa*) has also been shown to use a variety of host sources in southern Florida. While the Bartram's scrub-hairstreak has been consistently documented to use pineland croton, further natural history studies may indicate the subspecies' use of additional pine rockland plants for larval development.

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).

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 rarely encountered more than 5 m (16.4 ft) from its host plant-pine rockland interface (Schwartz 1987, p. 16; Worth *et al.* 1996, p. 65; Salvato and Salvato 2008, p. 324). Worth *et al.* (1996, p. 63) and Salvato and Hennessey (2004, p. 223) indicate that the hairstreak may have limited dispersal abilities. However, while the hairstreak is often described as sedentary, the need to evade natural disturbance (fires, storms) and subsequently recolonize suggests that adult hairstreaks—perhaps as a function of age, sex, or density—are adapted for effective dispersal throughout the pine rockland and associated ecosystems. Eggs are laid singly on the flowering racemes of pineland croton (Worth *et al.,* 1996, p. 62; Salvato and Hennessey 2004, p. 225). First and second instars remain well camouflaged amongst the white croton flowers, while the greenish later stages occur more on the leaves.

The Bartram's scrub-hairstreak has been observed during every month on Big Pine Key and in 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).

*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 and hydric pine flatwood vegetation when interspersed within the pine rockland habitat.

Detailed descriptions of pine rockland and rockland hammock habitats are presented in the proposed listing rule for the Florida leafwing and Bartram's scrub-hairstreak (78 FR 49882; August 15, 2013). The hydric pine flatwoods community, interspersed within pine rocklands, also supports Florida leafwing and Bartram's scrub-hairstreak within the Long Pine Key region of ENP (Sadle 2013c, pers. comm.). We include a full description of the hydric pine flatwoods forest community below.

*Hydric Pine Flatwoods*—Hydric pine flatwoods (Service 1999, pp. 231–238; FNAI 2010b, pp. 1–2) are open pine forests with a sparse or absent midstory and a dense groundcover of hydrophytic grasses, herbs, and low shrubs. The pine canopy typically consists of South Florida slash pine. Other pines may include longleaf pine (*P. palustris*),

pond pine (*P. serotina*), and loblolly pine (*P. taeda*). The subcanopy, if present, consists of scattered sweetbay (*Magnolia virginiana*), swamp bay (*Persea palustris*), loblolly bay (*Gordonia lasianthus*), pond cypress (*Taxodium ascendens*), dahoon (*Ilex cassine*), titi (*Cyrilla racemiflora*), and/or wax myrtle (*Myrica cerifera*). Shrubs include large gallberry (*Ilex coriacea*), fetterbush (*Lyonia lucida*), titi, black titi (*Cliftonia monophylla*), sweet pepperbush (*Clethra alnifolia*), red chokeberry (*Photinia pyrifolia*), and azaleas *(Rhododendron canescens, R. viscosum*). Saw palmetto (*Serenoa repens*) and gallberry *(I. glabra*), species characteristic of mesic flatwoods sites, may be present. On calcareous sites, cabbage palm (*Sabal palmetto*) is common both in the subcanopy and shrub layers. Herbs include wiregrass (*Aristida stricta var. beyrichiana*), blue maidencane (*Amphicarpum muhlenbergianum*), and/or hydrophytic species such as toothache grass (*Ctenium aromaticum*), cutover muhly (*Muhlenbergia expansa*), coastalplain yellow-eyed grass (*Xyris ambigua*), Carolina redroot (*Lachnanthes caroliana*), beaksedges (*Rhynchospora chapmanii, R. latifolia, R. compressa*), and pitcherplants (*Sarracenia* spp.), among others. Hydric pine flatwoods occur in the ecotones between the drier pine rocklands and rockland hammock habitats (FNAI 2010b, pp. 1–2).

The relative density of shrubs and herbs varies greatly in hydric pine flatwoods. Shrubs tend to dominate where fire has been absent for a long period or where cool-season fires predominate; herbs are more common in locations that are frequently burned. Soils and hydrology also may influence relative density of shrubs and herbs. Soils of shrubby hydric pine flatwoods are generally poorly to very poorly drained sands and include such series as Rutledge/Osier; these soils generally have a mucky texture in the uppermost horizon (FNAI 2010b, p. 2).

The general historical fire-return interval in pinelands across the southeastern U.S. coastal plain is estimated to be every 1–3 years (FNAI 2010b, p. 3). This interval is frequent enough to maintain grassy hydric pine flatwoods and inhibit invasion by shrubs (Drewa *et al.* 2002). Hydric pine flatwoods that are naturally shrubbier and dominated by slash pine may have had longer fire-return intervals, or perhaps a few periods of longer intervals, on the order of 5–7 years (Landers 1991), or up to 5–10 years (Grelen 1980), in order to allow the pines to establish and shrubs to proliferate.

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 (Skinner 1884, p. 180; Slosson 1895, p. 134; Comstock and Huntington 1943, p. 65; Kimball 1965, pp. 45–46; Baggett 1982, p. 78; Minno and Emmel 1994, pp. 626–627; 1994b, pp. 649–651; Smith *et al.* 1994, p. 67; Salvato 1999, p. 117; 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).

Destruction of pine rocklands for economic development has reduced this habitat in Miami-Dade County, including ENP, to about 11 percent of its natural extent, from approximately 74,000 hectares (ha) (183,000 acres (ac)) to only 8,140 ha (20,100 ac) in 1996 (Kernan and Bradley 1996, p. 2). Outside of ENP, only about 1 percent of the Miami Rock Ridge pinelands have escaped clearing, and much of what is left is in small remnant fragments isolated from other natural areas (Herndon 1998, p. 1). 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; Salvato 2013, pers. comm.; Maschinski *et al.* 2013, p. 14; Cook 2013, pers. comm.).

Breeding Florida leafwing populations have not been documented in pine rockland fragments adjacent to ENP for the past 25 years. 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 current distribution and abundance of pineland croton across all extant pine rockland fragments within Miami-Dade County is not known. However, a geographic information system analysis conducted by the Service using data collected by The Institute for Regional Conservation (IRC) in 2004, indicated that 77 pine rockland fragments (totaling 516 ha (370 ac)) in Miami-Dade County, contained pineland croton (IRC 2006, no page numbers). More recently, in 2012, the Service funded Fairchild Tropical Botanic Gardens (FTBG) to conduct extensive surveys of Miami-Dade pine rockland fragments to determine current pineland croton abundance and distribution. Pineland croton populations were encountered at 11 of the 13 locations surveyed, the largest occurring at Navy Wells Pineland Preserve and the Richmond Pine Rocklands, with each site retaining more than 21,000 individual plants (Maschinski *et al.* 2013, pp. 11–12).

In the lower Florida Keys, Big Pine Key retains the largest undisturbed tracts of pine rockland habitat (Zhang *et al.* 2010, p. 15; Roberts 2012, pers. comm.). At present, within the Florida Keys, pineland croton is known to occur only on Big Pine Key. Although the Bartram's scrub-hairstreak is extant on Big Pine Key, the Florida leafwing is believed to be extirpated from Big Pine Key since it 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). Results from all known historical surveys are provided in Table 1. More recent studies are discussed below.

TABLE 1—SUMMARY OF HISTORICAL 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). |
| 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). |

* USFWS—U.S. Fish and Wildlife Service; NPS—National Park Service.

Ongoing surveys conducted by Salvato (2014, pers. comm.) from 2009 to 2013 have recorded an average abundance of 2.7 adult Florida leafwings per ha (1 per ac), in Long Pine Key in ENP. In addition, surveys conducted by ENP staff from 2005 to present have encountered a total of approximately 34 and 216 leafwing adults and larvae, respectively, throughout Long Pine Key (Land 2012, pers. comm.; Sadle 2013b, pers. comm.).

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 (2012, pers. comm.) has found that the extant leafwing population within ENP is maintained at several hundred individuals or fewer, although numbers vary greatly depending upon season and other factors. However, Minno (2009, pers. comm.) estimated the extant leafwing population size at less than 100 at any given period.

Ongoing natural history studies of the leafwing by Salvato and Salvato (Salvato 2012, pers. comm.) and Sadle (2013d, pers. comm.) 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 historical (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; Anderson 2012a, pers. comm.; Land 2012, pers. comm.) surveys and natural history studies, there are extant Bartram's scrub-hairstreak populations 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 HISTORICAL 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). |

* USFWS—U.S. Fish and Wildlife Service; NPS—National Park Service.

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.

Hairstreaks often occur at low densities, fly erratically and are small, making them inherently difficult to monitor (Henry 2013, pers. comm.). Since early 2012, North Carolina State University personnel have collaborated with the Service on techniques to improve detection probabilities, estimate abundances, and measure vegetation characteristics associated with butterfly populations on the NKDR

(Henry and Haddad 2013, p. 1). These studies have documented a mean monthly count across sites ranging from 0.0 to 2.8 (with a standard error of ± 0.33) adult hairstreaks per ha (Anderson 2012a, pers. comm.). During 2013, using these survey techniques, NKDR documented a peak abundance of 159 adults in the early summer months (Anderson 2014, pers. comm.). Future monitoring efforts on NKDR will include counts in both currently and historically occupied areas.

Salvato and Salvato (2010b, p. 159) and Salvato (2014, pers. comm.) have encountered as many as 6.3 adult Bartram's scrub-hairstreaks per ha (2.5 per ac) annually from 1999 to 2013, based on monthly surveys in Long Pine Key. 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 2012, pers. comm.; Sadle 2013b, pers. comm.).

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)), Zoo Miami Preserve (300 ha (740 ac)), Martinez Pineland Park (53 ha (132 ac)), and U.S. Coast Guard lands in Homestead (29 ha (72 ac)) (Minno and Minno 2009, pp. 70–76; Possley 2010, pers. comm.). Adult butterflies have also been observed within Zoo Miami (Cook 2013, pers. comm.).

## 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.

### *Factor 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 (including within ENP) (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<br>Public—Monroe County.<br>Public—FDEP *, FWC *.<br>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 | 120 ha (296 ac). |
| Camp Owaissa Bauer | Public—Miami-Dade County | 40 ha (99 ac). |
| Richmond Pine Rocklands | Public—Federal (U.S. Coast Guard) | 359 ha (889 acres). |
| | Public—Miami-Dade County (Larry and Penny Thompson Memorial Park, Martinez Pineland Park, Miami Metro Zoo Preserve).<br>Private—University of Miami. | |
| **Florida Leafwing** | | |
| Everglades National Park—Long Pine Key. | Federal—National Park Service | 8,029 ha (19,840 ac). |

* FDEP—Florida Department of Environmental Protection; FWC—Florida Fish and Wildlife Conservation Commission.

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.

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 post-burn 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 2009, pers. comm.; 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 post-burn; however, it may take up to 6 months before the leafwing will use the new growth for oviposition (Lenczewski 1980, p. 35; Land 2009, pers. comm.; Salvato and Salvato 2010a, p. 95). Land (2009, pers. comm.) indicated that 96 percent of pineland croton burned during prescribed burns 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 post-burn, the majority of their observations indicated that oviposition and larval activity increased at about 3 to 6 months post-burn. Similarly, Land (2009, pers. comm.) reported finding leafwing larval activity on resprouting croton at 6 months post-burn. This finding suggests there may be some lag time between hostplant resurgence and compatibility with recolonization. However, observations of the Florida leafwing and Bartram's scrub-hairstreak within portions of Long Pine Key that have experienced fire or other disturbance regimes at intervals of up to 10 years (Salvato and Salvato 2010a; 2010b; Sadle 2013c, pers. comm.) suggest further studies are required on the influence of disturbance regime on butterfly ecologies.

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). Although further studies may be required to determine how the hairstreak responds to natural disturbances, 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 the 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 from prescribed burns with population densities greater than those recorded in any previous studies (Salvato and Salvato 2010b, p. 159), and this trend has continued subsequently (Land 2011, 2012a, pers. comm.; Salvato 2012, pers. comm.).

ENP is actively coordinating with the Service, as well as other members of the Imperiled Butterflies of Florida Workgroup, to review and adjust the prescribed burn practices outlined in ENP's Fire Management Plan (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. Revisions to the FMP are expected to be completed in early 2014, with prescribed burn activities resuming at that time.

Outside of 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 2010, pers. comm.). 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 burn 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; Saha *et al.* 2011, pp. 169–184). 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; Saha *et al.* 2011, pp. 169–184). 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; Anderson 2012a, pers. comm.). 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 2009, pers. comm.; 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. Ongoing and future studies on NKDR will be designed to measure the influence of prescribed burns and other management actions, such as mechanical clearing. 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 (Anderson 2010, pers. comm.). Because mechanical treatments may not provide the same ecological benefits as fire, NKDR continues to focus efforts on conducting prescribed burns where possible (Anderson 2012a, pers. comm.). Additional proposed experimental techniques that will be designed to simulate disturbance include complete vegetation removal (or scarping), fertilization (simulating the release of nutrients after fire), or other treatments that mimic fire influence (Haddad 2013, pers. comm., Anderson 2014, pers. comm.).

The NKDR is attempting to increase the density of hostplants within their pine rockland habitat through the use of prescribed burns. 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, Saha *et al.* 2011, pp. 169–184). 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, p. 123, Horn *et.al.,* 2013, pp. 1–67, Harley 2012, pp. 1–246). Prescribed burn implementation in the lower Keys has been hampered largely due to a shortage of resources, technical challenges, and expense of conducting prescribed burns 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 (Anderson 2010, pers. comm.). Given the difficulties in prescribed burn 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) (Anderson 2012b, pers. comm.).

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

Climatic changes, including sea level rise, are major threats to south Florida, and to 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 (Minno 2013, page numbers not applicable). In addition, the Florida leafwing also occurred on Big Pine Key until 2006, within the same locations as extant Bartram's scrub-hairstreak populations. Reestablishment 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 historical 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, with 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 historical hydrology of the Everglades and other natural systems in southern Florida (collectively known as the Comprehensive Everglades Restoration Plan (CERP)) may produce collateral impacts to extant pine rockland within Long Pine Key. Salvato (2012, pers. comm.) 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 (2012, pers. comm.) 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 (2013, pers. comm.) 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 National Park Service (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 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., the Service, NPS) are to consider the potential effects of their activities (e.g., prescribed burning, 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 (GMP) for ENP (Sadle 2013a, pers. comm.). 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.

*Factor 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 2011, pers. comm.).

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 2012, pers. comm.). 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 (2011, pers. comm.) 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 (2012, pers. comm.) 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 2009, pers. comm.; Nagano 2011, pers. comm.; Olle 2011, pers. comm.). 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 possible that some specimens are being poached. Alternatively, Calhoun (2013, pers. comm.) suggests that many specimens of the Florida leafwing and Bartram's scrub-hairstreak offered from sale online or elsewhere may come from older collections, as opposed to from poaching activities on conservation lands.

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 (2012, pers. comm.) 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). Cook (2013, pers. comm.) suggests that marking individuals improves the accuracy of population estimates by reducing sampling error from recounting or extrapolation. 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).

*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 (2009, pers. comm.) 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 (2009, pers. comm.) 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; 2011, 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.) parasitism ranged from 70 to 100 percent. Salvato and Salvato (2011, p. 2) continually encounter leafwing eggs that have been attacked by trichogrammid wasps, 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.* 2012a, p. 232) indicate they consistently parasitize leafwing larvae within Long Pine Key throughout their development.

Salvato and Salvato (2012, p. 1) and Sadle (2013d, pers. comm.) 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; Sadle 2013d, pers. comm.). The majority of mortality noted thus far in these studies has occurred in the earliest, immature stages. Caldas (2013, pers. comm.) suggests that, based on the high mortality of immature leafwing, often from natural factors such as parasitism, recovery efforts for these butterflies should be focused on the adult stage, specifically establishing and maintaining additional breeding populations.

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.* (2012b, 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). Many immature lycaenids, including those of the endangered Miami blue, demonstrate a symbiotic relationship with ants (Saarinen and Daniels 2006, p. 69; Trager and Daniels 2009, p. 474; Daniels 2013, pers. comm.), as a strategy to ward off predation. However, no such symbiotic relationship between Bartram's scrub-hairstreak larvae and ants has been documented (Salvato 1999, p. 124).

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 a 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 2012, pers. comm.). NKDR biologists have witnessed nonnative Cuban anoles (*Anolis equestris*) attempting to prey on adult Bartram's scrub-hairstreaks (Anderson 2013, pers. comm.). Minno and Minno (2009, p. 72) also cite nonnative predators such as ants as a major threat to both butterflies.

*Factor 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.

Federal

Existing Federal 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.

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 an SUP to the Florida Keys Mosquito Control District (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

Neither the Florida leafwing nor Bartram's scrub-hairstreak butterflies are currently listed by the State of Florida as a protected species under Chapter 68A–27, Rules Relating to Endangered or Threatened Species, so there are no existing State regulations designated to protect them. However, all State-owned property and resources are generally protected from harm in Chapter 62D–2.013(2), and animals are specifically protected from unauthorized collection in Chapter 62D–2.013(5) of the Florida Statutes.

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.

*Factor 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 2003, pers. comm.). Schweitzer (2003, pers. comm.) has also suggested that butterfly populations of fewer 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 2012, pers. comm.). 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 2012, pers. comm.), 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 2010a, 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 2012, pers. comm.). 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 possible limited dispersal abilities of this butterfly, the distance between these sites, (Worth *et al.* 1996, p. 63; Salvato and Hennessey 2004, 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, hurricane frequency should decrease by 10 to 30 percent, with a 5 to 10 percent wind increase. This anticipated result 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 historical 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 historical 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 (2009, pers. comm.) 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 2010, pers. comm.; Land 2010, pers. comm.; 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 that 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 (2011, pers. comm.) 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 2011, pers. comm.). 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 (2011, pers. comm.) 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 (2011, pers. comm.) 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 2010, pers. comm.; Land 2010, pers. comm.).

As described above (see *Factor C*), ongoing natural history studies by Salvato and Salvato (2012, 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 National Wildlife Refuge, 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 m (820 yards (yd)) from the target area; residues of fenthion (an adulticide no longer used in the Keys) applied via truck were found up to 50 m (55 yd) 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 (2011, pers. comm.) conducted two field trials on NKDR that detected significant naled residues at locations within nontarget areas on the Refuge that were up to 402 m (440 yd) 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 (2011, pers. comm.) 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 (Anderson 2013, pers. comm.).

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 Policy 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) of the 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 (Anderson 2012a, pers. comm.; 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 2012, pers. comm.). 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.

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 2007, pers. comm.). Spraying occurred within ENP following hurricanes in 2005 (Perry 2008, pers. comm.). 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 2013, pers. comm.)

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.

*Cumulative Effects From Factors A Through 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.

**Summary of Biological Status and Threats**

*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 and predation (*Factor C*), and 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 reduce these threats. 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 populations 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 five 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 and predation (*Factor C*), and small population size, restricted range, and influence of chemical pesticides used for mosquito control (*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.

*Both Species*

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 burns, 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.

**Determinations**

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 fragmentation, including climatic change and lack of adequate fire management (*Factor A*); poaching (*Factor B*); parasitism and predation (*Factor C*); the inadequacy of existing regulatory mechanisms, including limited enforcement (*Factor D*); and small population size, restricted range, and influence of chemical pesticides used for mosquito control (*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 and Bartram's scrub-hairstreak butterflies are presently in danger of extinction throughout their entire ranges based on the severity and immediacy of threats currently impacting these subspecies. Their overall ranges have been significantly reduced; the remaining habitats and populations are threatened by a variety of factors acting in combination to reduce the overall

viability of these subspecies. The risk of extinction is high because the remaining populations are small and isolated and the potential for recolonization is limited. Therefore, on the basis of the best available scientific and commercial data available, we have determined that the Florida leafwing and Bartram's scrub-hairstreak butterflies meet the definition of endangered in accordance with sections 3(6) and 4(a)(1) of the Act.

Under the Act and our implementing regulations, a species may warrant listing if it is endangered or threatened throughout all or a significant portion of its range. The threats to the survival of these 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.

**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 reclassified to threatened 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.

Following publication of this final listing rule, funding for recovery actions will be available from a variety of sources, including Federal budgets, State programs, and cost-share grants for non-Federal landowners, the academic community, and nongovernmental organizations. In addition, 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*.

Please let us know if you are interested in participating in recovery efforts for either or both of 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. When a species is listed, 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 consultation as described in the preceding paragraph include but are not limited to, 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 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, make it illegal for any person subject to the jurisdiction of the United States to take (which includes harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect; or to attempt any of these) endangered wildlife within the United States or on the high seas. In addition, it is unlawful to import; export; deliver, receive, carry, transport, or ship in interstate commerce in the course of commercial activity; or sell or offer for sale in interstate or foreign commerce any listed species. It is also illegal to possess, sell, deliver, carry, transport, or ship any such wildlife that has been taken illegally. Certain exceptions apply to agents of the Service, the National Marine Fisheries Service, other Federal land management agencies, and State conservation agencies.

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

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. Based on the best available information, the following activities could potentially result in a violation of section 9 of the Act; this list is not comprehensive:

(1) Unauthorized possession, collecting, trapping, capturing, killing, harassing, sale, delivery, or movement, including interstate and foreign commerce, or harming or attempting any of these actions, 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 kill or injure 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 species.

(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**).

## Required Determinations

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

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

*Government-to-Government Relationship With Tribes*

In accordance with the President's memorandum of April 29, 1994 (Government-to-Government Relations with Native American Tribal Governments; 59 FR 22951), Executive Order 13175 (Consultation and Coordination with Indian Tribal Governments), and the Department of the Interior's manual at 512 DM 2, we readily acknowledge our responsibility to communicate meaningfully with recognized Federal Tribes on a government-to-government basis. In accordance with Secretarial Order 3206 of June 5, 1997 (American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act), we readily acknowledge our responsibilities to work directly with tribes in developing programs for healthy ecosystems, to acknowledge that tribal lands are not subject to the same controls as Federal public lands, to remain sensitive to Indian culture, and to make information available to tribes. Neither species occurs on any tribal lands or lands under tribal jurisdiction.

## 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).

## List of Subjects in 50 CFR Part 17

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

## Regulation Promulgation

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

## PART 17—[AMENDED]

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

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

■ 2. Amend § 17.11(h) by adding 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 | | Historical range | Vertebrate population where endangered or threatened | Status | Family | When listed | Critical habitat | Special rules |
|---|---|---|---|---|---|---|---|---|
| Common name | Scientific name | | | | | | | |
| * | * | * | * | | * | * | | * |
| INSECTS | ..... | ..... | ..... | | ..... | ..... | ..... | ..... |

| Species | | Historical range | Vertebrate population where endangered or threatened | Status | Family | When listed | Critical habitat | Special rules |
|---|---|---|---|---|---|---|---|---|
| Common name | Scientific name | | | | | | | |
| * | * | * | * | | * | * | | * |
| Butterfly, Bartram's scrub-hairstreak. | Strymon acis bartrami. | U.S.A. (FL) ..... | NA | E | Lycaenidae ..... | 843 | 17.95(i) | NA |
| * | * | * | * | | * | * | | * |
| Butterfly, Florida leafwing. | *Anaea troglodyta floridalis*. | U.S.A. (FL) ..... | NA | E | Nymphalidae ..... | 843 | 17.95(i) | NA |
| * | * | * | * | | * | * | | * |

Dated: July 22, 2014.

**Stephen Guertin,**

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

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