U.S. FISH AND WILDLIFE SERVICE SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

Scientific Name:

Strymon acis bartrami

Common Name:

Bartram's Hairstreak Butterfly

Lead region:

Region 4 (Southeast Region)

Information current as of:

06/15/2010

Status/Action

___ Funding provided for a proposed rule. Assessment not updated.

___ Species Assessment - determined species did not meet the definition of the endangered or threatened under the Act and, therefore, was not elevated to the Candidate status.

___ New Candidate

_X_ Continuing Candidate

___ Candidate Removal

___ Taxon is more abundant or widespread than previously believed or not subject

___ Taxon not subject to the degree of threats sufficient to warrant issuance of

___ Range is no longer a U.S. territory

___ Insufficient information exists on biological vulnerability and threats to s

___ Taxon mistakenly included in past notice of review

___ Taxon does not meet the definition of "species"

___ Taxon believed to be extinct

___ Conservation efforts have removed or reduced threats

Petition Information

_X_ Non-Petitioned

___ Petitioned

90-Day Positive:

12 Month Positive:

Did the Petition request a reclassification?

For Petitioned Candidate species:

Is the listing warranted(if yes, see summary threats below)

To Date, has publication of the proposal to list been precluded by other higher priority listing?

Explanation of why precluded:

We find that the immediate issuance of a proposed rule and timely promulgation of a final rule for this species has been, for the preceding 12 months, and continues to be, precluded by higher priority listing actions (including candidate species with lower LPNs). During the past 12 months, the majority our entire national listing budget has been consumed by work on various listing actions to comply with court orders and court-approved settlement agreements; meeting statutory deadlines for petition findings or listing determinations; emergency listing evaluations and determinations; and essential litigation-related administrative and program management tasks. We will continue to monitor the status of this species as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures. For information on listing actions taken over the past 12 months, see the discussion of Progress on Revising the Lists, in the current CNOR which can be viewed on our Internet website (http://endangered.fws.gov/).

Historical States/Territories/Countries of Occurrence:

- **States/US Territories**: Florida
- **US Counties**: Miami-Dade, FL, Monroe, FL
- **Countries**:Country information not available

Current States/Counties/Territories/Countries of Occurrence:

- **States/US Territories**: Florida
- **US Counties**: Miami-Dade, FL, Monroe, FL
- **Countries**:Country information not available

Land Ownership:

The mainland population is within Long Pine Key in Everglades National Park (ENP). Total acreage including land and water of ENP in Miami-Dade, Monroe, and Collier Counties is 610,684 hectares (ha) [1,509,000 acres (ac)]. In addition, sporadic and localized occurrences of Bartram’s hairstreak (Strymon acis bartrami) have been found within pine rockland fragments on lands owned by Miami-Dade County. Relict pine rocklands on other private lands may also provide suitable or potential habitat. In the Florida Keys, the butterfly occurs on Big Pine Key within National Key Deer Refuge (NKDR) and on private, State, and other lands (Salvato and Hennessey 2004, p. 223; Salvato and Salvato 2010a, p. 154). The NKDR is 3,723 ha (9,200 ac).

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Biological Information

Species Description:

The Bartram's hairstreak is a small butterfly approximately 25 millimeters (mm) (1 inch [in]) in length with a forewing length of 10.0 to 12.5 mm (0.4 to 0.5 in) and has an appearance (i.e., color, size, body shape) characteristic of the genus (Pyle 1981, p. 480; Opler and Krizek 1984, pp. 107-108; Minno and Emmel 1993, p. 129). Despite its rapid flight, this hairstreak is easily observed if present at any density as it alights often, and the brilliance of its grey underside marked with bold, white postdiscal lines beneath both wings provides an instant flash of color against the foliage of its host plant, pineland croton (Croton linearis) (Euphorbiaceae) (Smith et al. 1994, p. 118; Salvato 1999, p. 124). The Bartram's hairstreak does not exhibit sexual or seasonal dimorphism, but does show some sexual differences. The abdomen of the male is bright white, while females are gray (M. Minno, Eco-Cognizant, Inc., pers. comm. 2009).

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. Salvato and Hennessey (2004, p. 225) reported approximate body lengths of 2, 4, 6, and 11 mm for Bartram's hairstreak for the second through fifth instar larvae, respectively.

Taxonomy:

The Bartram's hairstreak butterfly, Strymon acis bartrami, was first described by Comstock and Huntington in 1943. Seven subspecies of Strymon acis have been described (Smith et al. 1994, p. 118). Smith et al. (1994, p. 118) indicated that perhaps no other butterfly in the West Indies has evolved as many distinct island subspecies as S. acis. Each group of Antillean islands appears to have its own particular set of S. acis hairstreaks, and these have been classified into two separate groups. The Type A subspecies are larger, darker colored and are found in the more southeastern Antillean islands. The Type B subspecies, to which the Bartram's hairstreak belongs, are smaller, more surface-grey colored. Bartram's hairstreak is endemic to Florida and occurs nowhere else in the world.

The Integrated Taxonomic Information System (2011, p. 1) uses the name Strymon acis bartrami and indicates that this species' taxonomic standing is valid. The Florida Natural Areas Inventory (FNAI) (2011, p. 20) and NatureServe (2010, p. 1) use the name S. a. bartrami.

We have carefully reviewed the available taxonomic information on the Bartram's hairstreak (Smith et al. 1994, p. 118; Worth et al. 1996, p. 62; Salvato and Hennessey 2004, p. 223; Pelham 2008, p. 231) and have reached the conclusion that S. acis bartrami is a valid taxon and an entity that could be listed pursuant to the Endangered Species Act.

Habitat/Life History:

Pineland croton, a subtropical species of Antillean origin, is the only known host plant for Bartram's hairstreak (Opler and Krizek 1984, p. 108; Schwartz 1987, p. 16; Minno and Emmel 1993, p. 129; Smith et

al. 1994, p. 118). On the mainland, 1,068 ha (2,639 ac) of pine rockland habitat with pineland croton occur within ENP (Hennessey and Habeck 1991, p. 4; Salvato 1999, p. 3). ENP staff and volunteers are mapping croton throughout Long Pine Key, but more information on its distribution is needed (J. Sadle, NPS, pers. comm. 2007, 2010a, 2011a; S. Perry, NPS, pers. comm. 2007).

A GIS analysis for Miami-Dade County indicated that 65 pine rockland fragments containing croton remain in private ownership, totaling approximately 190 ha (470 ac) (The Institute for Regional Conservation [IRC] 2006, p. N/A). Another 12 fragments totaling 180 ha (446 acres) contain croton and are in public ownership (IRC 2006, p. N/A).

In the Florida Keys, pineland croton once occurred throughout the pine rocklands of the lower Keys (Dickson 1955, p. 98; Hennessey and Habeck 1991, p. 13; Salvato 1999, p. 3), and now apparently only occurs on Big Pine Key. The last reports of the host plant from other keys were from No Name in 1992 (Carlson et al. 1993, p. 923) and from Little Pine (Hennessey and Habeck 1991, p. 4). Recent surveys of relict pineland throughout the lower Keys by Salvato (1999, pers. comm. 2008) failed to locate the plant from any island other than Big Pine. Hennessey and Habeck (1991, p. 4) and Salvato (1999, p. 3) estimated that approximately 80 ha (198 ac) of croton-bearing pine rockland habitat occur on Big Pine Key. More recently, Chad Anderson (pers. comm. 2010a), biologist at NKDR, estimated roughly 243 ha (600 ac) of croton on Big Pine Key, based upon Bradley's pine rockland data and personal observations.

In pine rockland habitat, frequent fires burn back the overgrowth of the herbaceous layer. Most shrubs, including pineland croton, re-sprout after fire. Re-sprouting after burns is the primary mechanism allowing for the persistence of perennial shrubs in pine habitat (Olson and Pratt 1995, p. 101). In most instances croton returns at 1 to 3 months post-burn, however it may take up to 6 months before the hairstreak will use the new growth for oviposition (Salvato and Salvato 2010a, pp. 157-158; A. Land, pers. comm. 2010; C. Anderson, pers. comm. 2010a). On Big Pine Key, Anderson (pers. comm. 2010a) found new seed germination (n = 102 in approximately 10 ac) at approximately 4 months after fire and noted the ratio of seedling germination to resprouts was more than 2:1 (102:45, n = 261) in the crotons surveyed in his study. Without fire, tropical pineland changes to hardwood hammock as broad-leaved trees and shrubs shade out the pineland plants. In the Keys, the conversion of pine rockland into hardwood hammock is continuing on northeastern Big Pine, No Name, Cudjoe, Sugarloaf, and Little Pine Keys. Pineland croton is now absent from these locations.

This species is rarely encountered more than 5 meters (m) (16.4 feet) from its host plant (Schwartz 1987, p. 16; Worth et al. 1996, p. 65; Salvato and Salvato 2008, p. 324). Salvato and Salvato (2010a, p. 159) suggest a fire-return interval of 3 to 5 years may be most conducive for maintaining Bartram’s hairstreak on the mainland; less frequent fire is needed in the Keys. Due the species limited dispersal capabilities it is important to maintain patches of hostplant in close proximity to sufficient nectar sources. Ideal habitat may be nearly uniform/evenly distributed croton interspersed with nectar sources and trees.

Females oviposit on the flowering racemes of pineland croton (Worth et al. 1996, p. 62; Salvato and Hennessey 2004, p. 225). Eggs are laid singly on the developing flowers. Hennessey and Habeck (1991, p. 18) observed a female oviposit three eggs over the course of 5 minutes. This long duration likely enables females to serve as one of the major pollinating species for the host plant (Salvato 2003, p. 57).

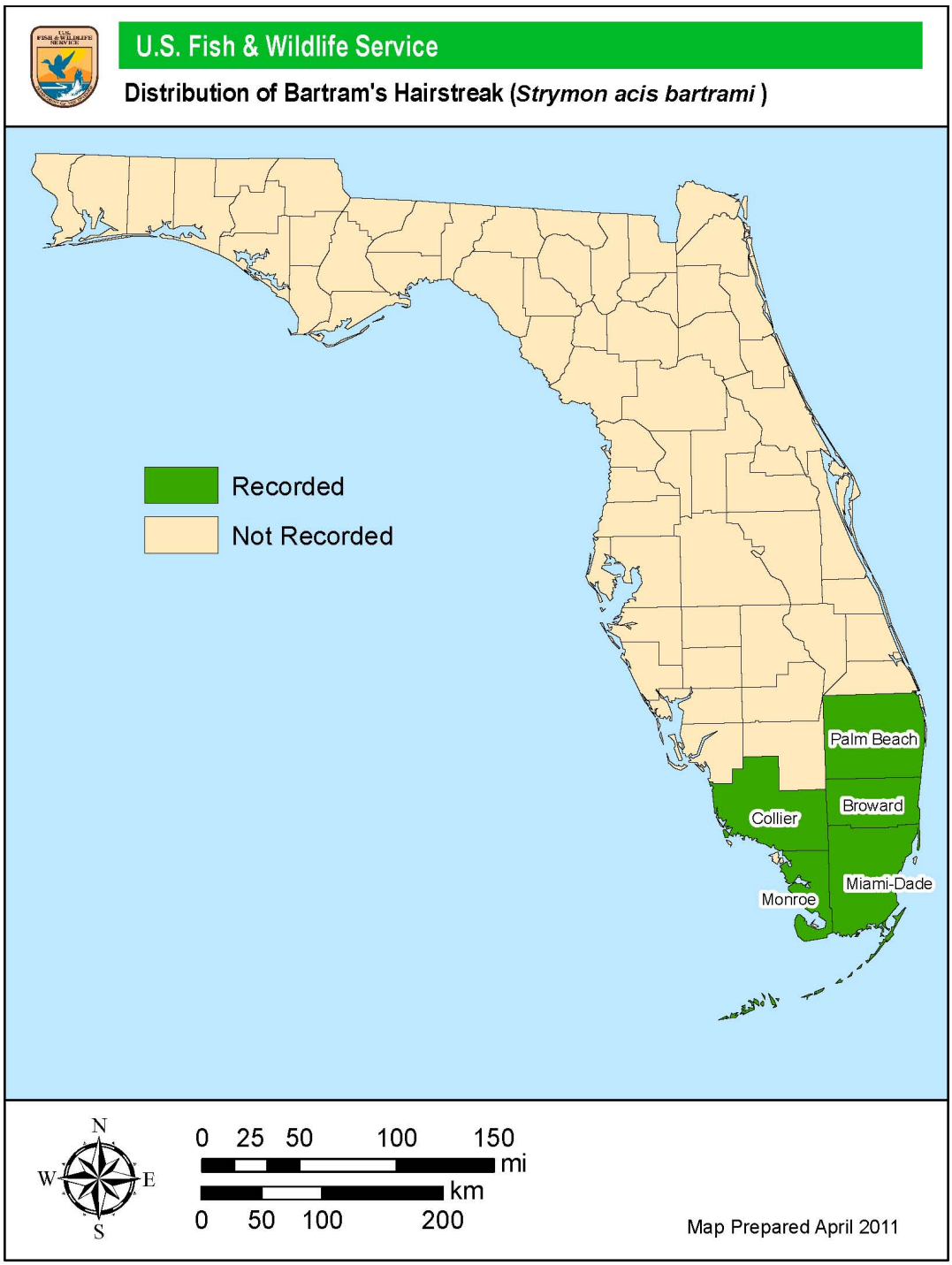
The Bartram's hairstreak is most often observed visiting pineland croton flowers for nectar, but has also been observed using the flowers of other species, including: pine acacia (Acacia pinetorum), Spanish needles (Bidens alba), saw palmetto (Serenoa repens), buttonsage (Lantana involucrata), Bloggett’s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

The Bartram’s hairstreak has been observed during every month on Big Pine Key and ENP; however the

exact number of broods appears to be sporadic from year to year (Salvato and Hennessey 2004, p. 226; Salvato and Salvato 2010a, p. 156). Baggett (1982, p. 81) indicated that the Bartram's hairstreak seemed most abundant in October-December. Salvato and Salvato (2010a, p. 156) encountered the species most often during March to June within ENP. However, on Big Pine Key, Salvato (pers. comm. 2011a) has reported finding the species abundantly throughout the year, particularly during the summer months. Salvato (1999, p. 47) recorded 92 and 36 adult Bartram's hairstreak on Big Pine Key during 1-week periods in July 1997 and January 1998, respectively, suggesting the species can occur in high numbers during any season if suitable habitat and conditions are present (M. Salvato, pers. comm. 2011a).

Historical Range/Distribution:

Bartram's hairstreak is endemic to south Florida and the lower Keys. The species was locally common within the pine rockland habitat that occurred in Miami-Dade and Monroe Counties, and less common and more sporadic within croton-bearing pinelands in Collier, Palm Beach, and Broward Counties (Baggett 1982, p. 81; Smith et al. 1994, p. 118; Salvato and Hennessey 2004, p. 223). However, development has removed and/or fragmented pine rocklands from the majority of the hairstreak's former range (Salvato and Hennessey 2004, p. 223; Salvato and Salvato 2008, p. 323; 2010a, p. 154). This rapid loss of habitat and the resulting increased distance between substantial populations of host plants in the remaining pine rocklands is the most likely cause for the disappearance of the hairstreak from most of its historic range.



Current Range Distribution:

Populations of Bartram's hairstreak have become increasingly localized as pine rockland habitat has been lost or altered through anthropogenic activity (Lenczewski 1980, p. 43; Baggett 1982, p. 81; Hennessey and Habeck 1991, p. 4; Schwarz et al. 1996, p. 59; Salvato and Hennessey 2004, p. 223; Salvato and Salvato 2010a, p. 154). Long Pine Key in ENP contains the largest remaining coverage of pine rockland habitat (8,029 ha) (19,840 ac) on the mainland (Table 1) (Salvato 1999, p. 3; Service 1999, p. 173; Salvato and Hennessey 2004, p. 223). However, Hennessey and Habeck (1991, p. 4) and Salvato (1999, p. 3) estimated that approximately 1,068 ha (2,638 ac) of appropriate host plant-bearing pine rockland habitat (Table 1)

occur within Long Pine Key. This appears to be the best estimate at this time. More information on the distribution of croton within Long Pine Key is needed (J. Sadle, pers. comm. 2007, 2010b, 2011a; S. Perry, pers. comm. 2007).

In Miami-Dade County, outside of ENP, there are approximately 375 pine rockland fragments remaining totaling approximately 1,780 ha (4,398 ac; Table 1) (Service 1999, p. 173). Several of these fragments, particularly those adjacent to ENP, such as Navy Wells Pineland Preserve (Navy Wells) and Camp Owaissa Bauer Hammock, appear to maintain small, localized populations of pineland croton as well as sporadic occurrences of Bartram's hairstreak (Salvato 1999, p. 123; Salvato and Hennessey 2004, p. 223; M. Salvato, pers. comm. 2009). A GIS analysis conducted by the Service using data collected by IRC in 2004 indicated that 65 pine rockland fragments containing pineland croton remain in private ownership in Miami-Dade County totaling approximately 190 ha (470 ac; Table 1) (IRC 2006). Another 12 fragments totaling 180 ha (446 ac; Table 1) contain croton and are in public ownership (IRC 2006).

In the lower Keys, Big Pine Key retains the largest undisturbed tracts of pine rockland habitat totaling an estimated 701 ha (1,732 ac; Table 1) (Folk 1991, p. 218; Hennessey and Habeck 1991, p. 4; Salvato and Hennessey 2004, p. 223). Minno (pers. comm. 2009) notes that the 2004 land cover data from South Florida Water Management District maps 516 ha (1,276 ac) of pine rockland on Big Pine Key. Although relict pine rocklands can still be found on several other islands within NKDR, only Big Pine Key maintains pineland croton (Salvato 1999, p. 4; Salvato and Hennessey 2003, p. 243; 2004, p. 223). As a result, the Bartram's hairstreak is present only on Big Pine Key. Hennessey and Habeck (1991, p. 4) and Salvato (1999, p. 3) estimated that approximately 80 ha (198 ac; Table 1) of croton-bearing pine rockland occur on Big Pine Key. More recently, Anderson (pers. comm. 2010a) suggested an estimate of 243 ha (600 ac) of croton on Big Pine Key.

Table 1: Estimated area of pineland rockland habitat and pineland croton-bearing habitat.

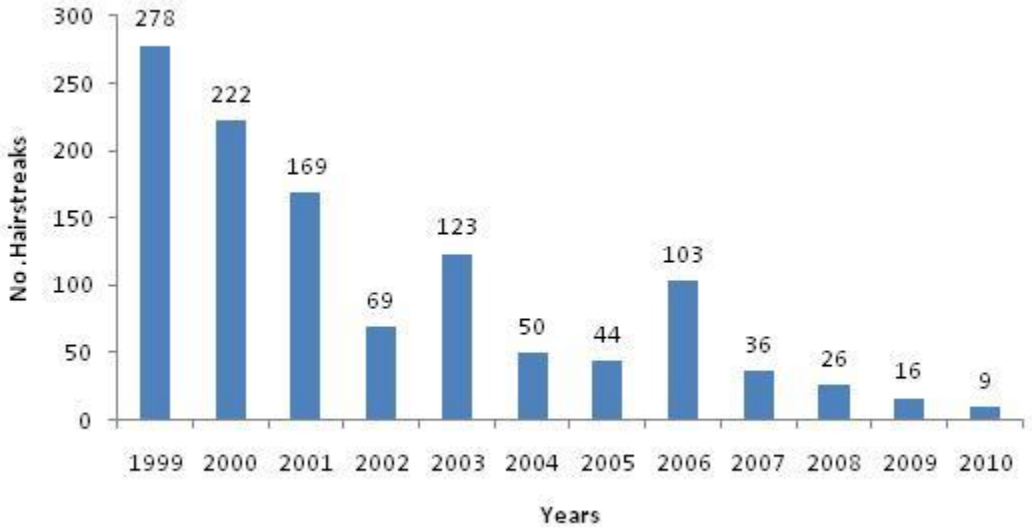
Site	Pine rockland habitat hectares (acres)	Pineland croton-bearing habitat hectares (acres)
Long Pine Key, ENP	8,029 (19,840)	1,068 (2,638)
Miami-Dade County	1,780 (4,398)	190 (470) – private ownership
		180 (446) – public ownership
Big Pine Key	701 (1,732)	80 (198) – 243 (600)
Total	**10,510 (25,970)**	**1,518 (3,752) – 1,761 (4,352)**

Population Estimates/Status:

Based on the results of historic (Baggett 1982, p. 80; Schwartz 1987, p. 16; Hennessey and Habeck 1991, pp. 117-119; 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; Salvato and Salvato 2010a, p. 154) surveys and natural history studies, the Bartram's hairstreak is extant in ENP and on Big Pine Key, while sporadically occurring in pineland fragments in mainland Miami-Dade County. Hennessey and Habeck (1991, pp. 49-50) reported an estimate of 3.9 and 1 adult Bartram's hairstreaks per ha (1.6 and 0.4 per ac) during 1988-1989 survey transects on Big Pine Key and Long Pine Key, respectively. During 1997-1998, Salvato (1999, p. 52) recorded an estimated 4.3 adults per ha (1.7 per ac) at survey transects across Big Pine Key. However, Salvato (1999, p. 52; 2001, p. 8) failed to find stable numbers in either the Watson's Hammock on Big Pine Key or in Long Pine Key. The lower densities in Watson's Hammock and Long Pine Key reported by Salvato (1999, p. 52; 2001, pp. 8-14; pers. comm. 2006) and Salvato and Hennessey (2004, p. 224) during the late 1980s and 1990s have been attributed to a lack of prescribed fires necessary to maintain host plants. Through 2010, Salvato and Salvato (unpublished data) indicate the total number of adults observed annually on Big

Pine Key has varied considerably from 9 to 278, based on monthly (1999-2006) or quarterly (2007-2010) surveys conducted from 1999 to 2010. The number of adults observed on Big Pine Key has declined precipitously over the duration of the Salvato's studies (see Figure 1).

Figure 1: Number of adult Bartram's hairstreaks observed annually on Big Pine Key based on monthly (1999-2006) and quarterly (2007-2010) surveys (M. H. Salvato and H. L. Salvato, unpublished data).



In March 2009, a high concentration of the butterfly and its host plant was recorded at one area of NKDR on Big Pine Key (C. Anderson, pers. comm. 2009). However, as of April 28, 2010, Anderson (pers. comm. 2010b) had only observed two adults on NKDR in 2010. Anderson initiated more intensive surveys for hairstreaks at one-hectare pine rockland transects (n = 6) across Big Pine Key during 2010. These studies noted an average of up to approximately 6 hairstreaks per ha during each weekly sampling period (C. Anderson, pers. comm. 2010c). Minno (pers. comm. 2007) reported observing less than 10 individuals after a day of sampling on Big Pine, which is "extremely low population numbers for a butterfly." Additional surveys on Big Pine Key during April 2011 produced only low numbers of the hairstreak across Big Pine Key (C. Anderson, pers. comm. 2011; M. Minno, pers. comm. 2011; Salvato, pers. comm. 2011a).

Salvato (1999, p. 122; 2003, p. 57) noted that the Bartram's hairstreak had either been extirpated or greatly reduced across the majority of Long Pine Key in ENP at the time of his 1997-1998 studies. However, due in large part to an effective and systematic burn plan, Salvato and Salvato (2010a, p. 159) have encountered as many as 15 adult Bartram's hairstreak annually at Gate 4 from 1999 to 2008. In addition, Salvato and Salvato (2010a, p. 156) has also monitored populations of the Bartram's hairstreak at other gates within Long Pine Key during 2005-2008 and encountered similar densities. Overall, Perry (pers. comm. 2007) has observed only small, scattered occurrences within the spatially extensive pineland area of Long Pine Key. She noted that counts are typically only in the single digits during her survey efforts.

Salvato (pers. comm. 2009) estimated that the populations collectively at Big Pine Key, Long Pine Key, and within relict pine rocklands adjacent to ENP ranges from several hundred or fewer, although it varies greatly depending upon season and other factors.

Despite extensive monitoring, Salvato (pers. comm. 2009) only sporadically observes the species within pine rockland areas adjacent to ENP. However, one such pine rockland fragment, Navy Wells, continues to maintain a consistent population of Bartram's hairstreak (Salvato and Salvato 2010a, p. 158). During 2008 through 2011, Salvato and Salvato (unpublished data) have frequently encountered adults at Navy Wells, including a high of 12 individuals on May 22, 2010. In recent years, annual winter frost events at Navy Wells

have served to temporarily reduce hostplant; however in each instance, both the plant and hairstreak have recovered quickly (M. Minno, pers. comm. 2007, 2009; J. Sadle, pers. comm. 2010a; M. Salvato, pers. comm. 2011). In addition, croton appears to have responded well to prescribed burns conducted throughout the preserve, with fresh croton growth occurring in many locations (Salvato and Salvato 2010a, p. 158).

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 hairstreak, including: Larry and Penny Thompson Memorial Park, Miami Metro Zoo Preserve, Martinez Pineland Park, and Coast Guard lands in Homestead (Minno and Minno 2009, pp. 70-76; J. Possley, Fairchild Tropical Botanic Garden [FTBG], pers. comm. 2010; E. Nuehring, pers. comm. 2011).

Minno (pers. comm. 2007) believes that this species has declined greatly since the 1980s and is not likely to survive without special efforts. Bartram's hairstreak may be at least as rare as the federally endangered Schaus swallowtail (Heraclides aristodemus ponceanus) (M. Minno, pers. comm. 2009). Minno (pers. comm. 2009) indicated that the current population size is not known, but thought to be declining; he believes it is likely to be less than 100 per day for all locations combined. Minno and Minno (2009, p. 76) recorded 143 adults on Big Pine Key, 36 adults in Miami-Dade County preserves, and 14 adults in ENP during surveys conducted in the Keys and southern Florida mainland from August 2006, through June 2009.

The Bartram's hairstreak has a rounded global status of T1, critically imperiled because of extreme rarity (i.e., 5 or fewer occurrences of less than 1,000 individuals) or because of extreme vulnerability to extinction due to natural or manmade factors (NatureServe 2010, p. 1). The basis for this ranking stems from the overall threats of: (1) range being reduced by development, (2) pesticide application, (3) fire (prescribed or otherwise), (4) complete fire suppression, and (5) hurricanes as well as restricted distribution, low abundance, and loss of habitat (NatureServe 2010, pp. 1-2). FNAI (2011, p. 20) places the butterfly's State rank at "S1", critically imperiled in Florida because of extreme rarity (5 or fewer occurrences or less than 1,000 individuals) or because of extreme vulnerability to extinction due to some natural or man-made factor. This butterfly is recognized in Florida's Comprehensive Wildlife Conservation Strategy as one of Florida's species of greatest conservation need, with status "low" and trend "unknown" (Florida Fish and Wildlife Conservation Commission [FWC] 2005, p. 91). Bartram's hairstreak is not listed in Florida, and there is no wildlife management plan for this species.

Threats

A. The present or threatened destruction, modification, or curtailment of its habitat or range:

The pine rockland community of southern Florida is globally endangered. Destruction of the pinelands for economic development has reduced this community by 90 percent on mainland south Florida (O'Brien 1998, p. 208). Similarly, most of the ecosystems on the 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). Suitable habitat for this butterfly on unprotected pine rocklands outside of ENP and NKDR largely remains at risk to development, fire suppression, and lack of fire management. Plans are underway to develop public lands adjacent to the Miami Metro Zoo for a water park (J. Maguire, pers. comm. 2010). However, Miami-Dade County has indicated it will construct the proposed water park in areas with existing concrete or areas otherwise not occupied by listed or candidate species (J. Maguire, pers. comm. 2010). Miami-Dade County appears willing to implement needed measures to protect the Bartram's hairstreak (J. Maguire, Miami-Dade County, pers. comm. 2008a). In addition, the County is working with FTBG to implement a fire monitoring program at its preserves (Possley and Maschinski 2007, pp. 1-13; J. Maguire, pers. comm. 2008b). As part of this program, croton will be mapped and fire effects will be studied (Possley and Maschinski 2007, p. 3; J. Maguire, pers.

comm. 2008a). Therefore, this development is not likely to curtail management of adjacent pine rocklands or cause habitat modification of areas, which currently support localized occurrences of Bartram's hairstreak (M. Salvato, pers. comm. 2010).

The threat of habitat destruction or modification is further exacerbated by lack of prescribed fire and suppression of natural fires, which are an important part of maintaining an ecosystem's gradual succession and are important in maintaining the herbaceous layer of pine rocklands of which pineland croton is a part (Loope and Dunevitz 1981, p. 5; Carlson et al. 1993, p. 914; Olson and Platt 1995, p. 101; Bergh and Wisby 1996, p. 1). Due to the proximity of remaining pine rockland habitat to urban areas, much of these natural fires (outside of ENP) have been suppressed, often replaced by inconsistent regimes of managed or prescribed fires.

Prescribed fire is used throughout the pine rocklands of Long Pine Key and has been consistently used for the past 50 years (Loope and Dunevitz 1981, p. 5; Salvato and Salvato 2010a, p. 154). Little is known about the fire history in ENP prior to 1947, and at first, fires were suppressed (Slocum et al. 2003, p. 93). Fires were reintroduced in the late 1950s, but were not well understood (Slocum et al. 2003, p. 93). However, many of the prescribed burns conducted in Long Pine Key during this time period were quite extensive, with several areas (now known as burn blocks) treated simultaneously. Beginning in 1989, efforts were made to generate more natural fire regimes by focusing on increasing frequency and shifting the timing of burn from the nonlightning (winter) to lightning (summer) seasons (Slocum et al. 2003, p. 93). In 1989 and 1990, all of Long Pine Key was prescribed burned during the early to middle lightning season to initiate a restoration effort based on the hypothesized natural fire regime (i.e., increased frequencies and correct timing) (Slocum et al. 2003, p. 93). Since that time, fires have been ignited every 2 to 3 years, with most ignitions occurring in the early to middle lightning season (Slocum et al. 2003, p. 93). Although this has resulted in restoration of species-rich, herbaceous-dominated pine rocklands in many areas, including resurgence of croton, populations of croton appear fragmented (Salvato and Hennessey 2004, p. 223). Because this butterfly is rarely encountered more than 5 m (16.4 feet) from its host plant (Schwartz 1987, p. 16; Worth et al. 1996, p. 65; Salvato and Salvato 2008, p. 324), it is believed that the historic large prescribed fires (i.e., involving multiple burn units) of Long Pine Key may have eradicated hairstreaks at the burn sites (Salvato 1999, p. 122). The desired fire return interval for prescribed fires in Long Pine Key is considered to be 2 to 5 years (A. Land, pers. comm. 2010). However, immature stages are destroyed by fire (M. Minno, pers. comm. 2009) (see Threats, Factor E below).

Since 2001, prescribed fire within Long Pine Key has been planned on a landscape scale versus unit scale (National Park Service [NPS] 2005, p. 27) using partial and systematic prescribed burns conducted in a way that burns nearly all of the pine rocklands over a 3-year window. These methods attempt to burn adjacent pine rockland habitats alternately. Salvato and Salvato (2010a, p. 159) indicate that the cyclic and alternating treatment of burn units may have benefited the hairstreak during much of their long-term studies throughout Long Pine Key. Providing refugia (i.e., unburned areas of croton [hostplant]) directly within (as well as adjacent to) the treatment area during prescribed burn activities may substantially increase the potential for the hairstreak to re-colonize recently burned areas and allow the species to remain within or near the fire-treated pineland (Salvato and Salvato 2010a, p. 159).

Ideally, as a result of cyclic burns and multi-year treatment intervals, the hairstreaks will move from the burned location to adjacent refugia and then back to burned area in numbers equal to or greater than before the fire. The effects of this new burn technique were not immediately obvious when this plan took effect, but starting in the fall of 2004 and continuing into early 2006, the hairstreak appeared to have benefited with population densities greater than those recorded in any previous studies (Salvato and Salvato 2010a, p. 159). However, at one point, low numbers of butterflies in the pinelands were partially attributed to burning too soon following hurricanes and flooding and before host plants were fully recovered, as well as other factors (S. Perry, pers. comm. 2007). In May 2005, select portions of Long Pine Key were prescribed burned, but resurgence of vegetation within these burned areas was set back due to storm damage caused by Hurricanes Katrina and Wilma later that year (Salvato and Salvato 2010a, p. 159). By mid-2006, croton within these

areas had not recovered, yet burns adjacent to these areas continued, temporarily removing available host plants (Salvato and Salvato 2010a, p. 159). However, ENP staff (A. Land, pers. comm. 2008) and Salvato and Salvato (2010a, p. 159; 2010b, p. 98) noted that unburned portions of the Long Pine Key pine rocklands retained the majority of their croton and appeared capable of supporting butterfly activity. In general, Salvato (pers. comm. 2010) believes that a fire-return interval of 3 to 5 years may be most conducive for maintaining Bartram's habitat on the mainland; less frequent fire is needed in the Keys. Although management in ENP in recent years has apparently benefited the Bartram's hairstreak, adaptive management needs to be implemented during instances where recovery of recently burned areas is slowed (Salvato and Salvato 2010a, p. 159).

In the Keys, the objectives of the current NKDR fire management program are to: (1) protect human life, property, and other resources from unwanted fire and (2) restore and maintain biological diversity using fire as a viable ecological process (Service 2000, p. 1). The latter includes maintaining biological diversity in fire-maintained plant communities by prescribed fire and also controlled natural fire under Service guidelines and maintaining habitat for trust resources, including listed species through prescribed fire and controlled natural fire (Service 2000, p. 1). The fire management plan for NKDR mentions Bartram's hairstreak and its reliance on its fire-dependent host plant and indicates that "Concern has been raised that fire suppression is contributing to the decline of these species as the host plant requires a fire maintained open pineland to persist (Emmel et al. 1995)," (Service 2000, p. 19). However, no specific details are provided to enhance habitat or to avoid or mitigate impacts to Bartram's hairstreak. In addition, management of pine rocklands by NKDR is made particularly difficult by the pattern of land ownership and development; private homes and light commercial uses are embedded within or in close proximity to pineland habitat (Service 2000, p. 10). Hand or mechanical vegetation management at colonies of Bartram's hairstreak may be necessary at select locations on Big Pine Key (Emmel et al. 1995; M. Minno, pers. comm. 2009). Anderson (pers. comm. 2010a) suggests that mechanical treatment may be effective in areas that are too dangerous to burn; however, the use of mechanical treatment might cause senescence of croton, since fire is a major driver for germination. Extreme clearing, like that for putting in fire breaks, generates a croton response, which may be a useful technique as a restoration project, but not in areas where an active colony exists (C. Anderson, pers. comm. 2010a).

Salvato (1999, p. 151; 2003, p. 57) and Salvato and Salvato (2010c, p. 139) indicated that burns are not being administered as thoroughly on Big Pine Key, as is needed to prevent loss of pine rocklands. As a result, many of the pine rocklands, across Big Pine Key, such as within northern Watson's Hammock, are being compromised by hardwood hammock (Salvato and Hennessey 2004, p. 225; Salvato and Salvato 2010c, p. 139). In addition, fire breaks leading into Watson's Hammock have been expanded; these expansions included cutting back and removing large quantities of native vegetation, including croton (M. Salvato, pers. comm. 2008). During 2009, a fire break on NKDR, running the length of Key Deer Boulevard on Big Pine Key, was mowed by volunteers, thereby cutting back numerous crotons (M. Salvato, pers. comm. 2010). For over a decade the crotons growing within these fire breaks have been actively used by the species (M. Salvato, pers. comm. 2010).

The NKDR is attempting to increase the density of host plants within their pine rockland habitat through the use of prescribed fire. However, there is a backlog of pine rocklands that need to be burned. Of 318 pine rockland plots that were initially assessed on Big Pine Key in 2005, 110 were not burned, 77 were burned once, 55 were burned twice, and 76 were burned either three or four times since 1960 (Bradley and Saha 2009, p. 22). Complete implementation of a prescribed fire program in the lower Keys has been hampered by an incomplete understanding of the fire ecology in the area, a shortage of resources, and by public opposition to burning. Complicating the issue is that many homes on Big Pine Key have been built in a mosaic of pine rockland, so the use of prescribed fire in many places has become complicated because of potential danger to structures. The Service is working cooperatively with Florida International University to determine the proper fire frequencies necessary to maintain the pine rockland community on NKDR (Snyder et al. 2005, pp. iv - v). Only two burns totaling 4 ha (10 ac) were conducted on NKDR in 2009 (A. Morkill, NKDR, pers. comm. 2010). Until more prescribed fires are conducted, fire breaks may provide good habitat on the island

because these areas are open, yet mowed or cleared very rarely (C. Anderson, pers. comm. 2010a). For example, Anderson (pers. comm. 2010a) found croton to be at a density of 0.04 plants per m2 in the forested plots and 0.27 m2 plants per plot on the fire breaks. Overall, lack of appropriate fire management continues to be a threat for this species at NKDR and surrounding lands on Big Pine Key. Future actions should avoid mowing of fire breaks with high densities of host plants and implementing more fire in overgrown areas on NKDR, to the extent possible.

In general, lack of adequate fire management continues to be a threat for this species at NKDR, on surrounding lands on Big Pine Key, and in fragmented pine rocklands where it is difficult to implement prescribed fire. However, NKDR is taking steps to monitor croton before and after fire, protect larvae during burns, and ensure that appropriate corridors are maintained in the small burns it conducts (C. Anderson, pers. comm. 2010a). Fire is essential for persistence of croton, and prescribed fire is essential to minimizing the threat from wildfire (C. Anderson, pers. comm. 2010a). During a wildfire event, managers do not have the ability to consider corridors or burn parameters such as size, heat, smoke, and rate of spread (C. Anderson, pers. comm. 2010a).

Climatic changes, including sea level rise, are major threats to south Florida, including the Bartram's hairstreak and its habitat. Known occurrences and suitable habitat are in low-lying areas and will be affected by rising sea level. In general, the Intergovernmental Panel on Climate Change (IPCC) reported that the warming of the world's climate system is unequivocal based on documented increases in global average air and ocean temperatures, unprecedented melting of snow and ice, and rising average sea level (IPCC 2007, p. 2; 2008, p. 15). Sea-level rise is the largest climate-driven challenge to low-lying coastal areas and refuges in the sub-tropical 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 0.088 inches (0.224 cm) annually between 1913 and 2006 (National Oceanographic and Atmospheric Administration [NOAA] 2008, p. 1). This equates to approximately 8.76 inches (22.3 cm) in 100 years (NOAA 2008, p. 1).

The IPCC (2008, p. 28) emphasized it is very likely that the average rate of sea-level rise during the 21st century will exceed that from 1961 to 2003, although it was projected to have substantial geographical variability. Partial loss of the Greenland and/or Antarctic ice sheets could result in many feet (several meters) of sea-level rise, major changes in coastlines, and inundation of low-lying areas (IPCC 2008, pp. 28-29). Low-lying islands and river deltas will incur the largest impacts (IPCC 2008, pp. 28-29). According to CCSP (2008, pp. 5-31), much of low-lying, coastal south Florida "will be underwater or inundated with salt water in the coming century." This means that most occupied, suitable, and potential habitat for Bartram's hairstreak will likely be either submerged or affected by increased flooding.

The 2007 IPCC report found a 90 percent probability of an additional 7 to 23 inches possibly as high as many feet (several meters) of sea level rise by 2100 in the Keys. This would cause major changes to coastlines, and inundation of low-lying areas like the Keys (IPCC 2008, pp. 28-29). The IPCC (2008, pp. 3, 103) concluded that climate change is likely to increase the occurrence of saltwater intrusion as sea level rises. Since the 1930s, 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). 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. In the Keys, elevation differences between such communities are very slight (Ross et al. 1994, p. 146), and horizontal distances are also small. Human developments will also likely be significant factors influencing whether natural communities can move and persist (IPCC 2008, p. 57; CCSP 2008, p. 7-6). For the Bartram's hairstreak, this means that much of the butterfly's habitat in the Keys, as well as habitat in other parts of its historic range, will likely change as vegetation changes be lost as habitat becomes inundated and vegetation shifts occur. Any deleterious changes to important loss and displacement of host plants could further diminish the likelihood of the subspecies' survival and recovery.

TNC (2010, p. 1) used Light Detection and Ranging (LIDAR) remote sensing technology to derive digital elevation models and predict future shorelines and distribution of habitat types for Big Pine Key based on sea level rise predictions ranging from the best-case to worst-case scenarios described by current scientific literature. In the Keys, models 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, a rise of 7 inches (18 cm) would result in the inundation of 1,840 acres (745 ha) (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 4.6 feet (140 cm) would result in the inundation of about 5,950 acres (2,409 ha) (96 percent) and the loss of all upland habitat (TNC 2010, p. 1). If modeling is accurate, under the worst-case scenario, even upland habitat on Big Pine Key will become submerged thereby removing or reducing habitat for the Bartram's hairstreak.

Similarly, using a spatially explicit model for the Keys, Ross et al. (2009, p. 473) found that mangrove habitats will expand steadily at the expense of upland and traditional habitats as sea level rises. Most of the upland and transitional habitat in the central portion of Sugarloaf Key is projected to be lost with a 0.2 meter-rise (0.7 foot-rise) in sea level; a 0.5-meter rise (1.6 foot-rise) in sea level can result in a 95 percent loss of upland habitat by 2100 (Ross et al. 2009, p. 473). Furthermore, Ross et al. (2009, pp. 471-478) suggested that interactions between sea-level rise and pulse disturbances (e.g., storm surges or fire [see Factor E]) can cause vegetation to change sooner than projected based on sea level alone.

Scientific evidence that has emerged since the publication of the IPCC Report (2007) indicates an acceleration in global climate change. Important aspects of climate change seem to have been underestimated previously and the resulting impacts are being felt sooner. For example, early signs of change suggest that the 1°C of global warming the world has experienced to date may have already triggered the first tipping point of the Earth's climate system - the disappearance of summer Arctic sea ice. This process could lead to rapid and abrupt climate change, rather than the gradual changes that are currently forecasted. Other processes to be affected by projected warming include temperatures, rainfall (amount, seasonal timing, and distribution), and storms (frequency and intensity) (see Factor E). The MIT scenarios combine 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 will have significant effects on the Keys (e.g., increased inundation and storm surges, losses of habitat, shifts in vegetation, changes in weather patterns).

In summary, sporadic, local occurrences of the butterfly and suitable habitat on unprotected pine rocklands outside of ENP and NKDR largely remain at risk to development, fire suppression, and lack of fire management. This threat is considered to be of high magnitude and imminent. The threat of destruction, modification, or curtailment of habitat due to wildfire and fire management appears to have been lessened in ENP, but continues on NKDR, County, and surrounding private lands. This threat is imminent and of high magnitude. Climatic changes, including sea level rise, are major threats that will ultimately substantially reduce the extent of habitat, especially in the Keys.

B. Overutilization for commercial, recreational, scientific, or educational purposes:

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 (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. Richard J. Skalski, Thomas W. Kral, and Marc L. Grinnell, Case No. CR932017, U.S. District Court [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 over 30,000 endangered and/or 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 Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) during port inspections in Florida, often without necessary declaration (E. McKissick, Service, pers. comm. 2011).

In the past, when the hairstreak was widespread on Big Pine Key and throughout southern Miami-Dade County, collecting likely exhibited little pressure on this species. At present, even limited collection from the small populations within and adjacent to ENP and on Big Pine Key could have deleterious effects on reproductive and genetic viability and thus could contribute to its eventual extinction. Illegal collection could occur within conservation lands without being detected since these areas are not actively patrolled. 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 collection is prohibited. Consequently, the potential for unauthorized or illegal collection of eggs, larvae, pupae, and, or adults exists and could go undetected, despite the protection provided on Federal or other public lands.

We have direct evidence of interest in the collecting, as well proposed commercial sale of, the Bartram's hairstreak. Salvato (pers. comm. 2011) has also been contacted by several individuals requesting specimens of the Bartram's hairstreak, as well as another south Florida candidate butterfly, the Florida leafwing (Anaea troglodyta floridalis), or seeking information regarding locations where they may be collected in the field. Salvato (pers. comm. 2011) observed several individuals collecting butterflies at Navy Wells during 2005, including on dates when Bartram's hairstreak was present at this site. Multiple websites offer specimens of south Florida's candidate butterflies for sale (M. Minno, pers. comm. 2009; M. Salvato, pers. comm. 2011b). At one website, Bartram's hairstreak can be purchased for 10.00 euros ($14.00). It is unclear where the specimens originated from or when these were collected. The species can be easily found on private lands on Big Pine Key and perhaps locally within Miami-Dade County. However, given that the majority of known Bartram's hairstreak populations now occur within protected conservation lands it is highly likely some specimens are being poached. Thus, there is established collection pressure for the Florida leafwing.

In summary, we have direct evidence that interest in collection and proposed commercial sale of the Bartram's hairstreak are occurring. Due to the small size of remaining populations, restricted range, and remoteness of occupied habitat, we believe that collection has the potential to be a serious threat to the species at any time. Even limited collection could have deleterious effects on reproductive and genetic viability and thus could contribute to its extinction.

C. Disease or predation:

Native parasites and predators have been documented to impact Bartram's hairstreaks. Hennessey and Habeck (1991, p. 19) collected a fifth-instar larva of Bartram's hairstreak on Big Pine Key from which during pupation a single braconid wasp was produced. During December 2010 Salvato and Salvato (in press) encountered late instar Bartram's hairstreak larva within Long Pine Key that had been parasitized by Chetogena scutellaris (Diptera: Tachinidae). These endoparasitic flies lay their white eggs on the outer integument of hairstreak larvae. The fly larvae (maggots) emerge to burrow into the side of the butterfly larva leaving dark entry holes (necrosis) on the epidermis. These fly maggots feed on the larva as it develops. As the late instar hairstreak larva begins to pupate the mature tachinid maggots emerge killing the butterfly larva in the process. Ongoing studies of Florida leafwing larvae in Long Pine Key have indicated that C. scutellaris serves as a consistent mortality factor to the species, and possibly other butterflies, such as the Bartram's hairstreak (Salvato et al. 2009, p. 101; Salvato and Salvato 2010b, p. 95). These are the only known records for a larval parasitoid on this species. Tracking the fate of Bartram's hairstreak pupae is extremely difficult because it pupates in the ground litter (Worth et al. 1996, p. 63). Collection of other parasitized late instar Bartram's hairstreak larvae is needed to determine the influence of parasitism on its early stages (Salvato and Hennessey 2004, p. 225).

In May 2010, Salvato and Salvato (2010d, p. 71) observed erythraeid larval mite parasites on an adult Bartram's hairstreak (Strymon acis bartrami) (Lycaenidae) 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 Bartram's hairstreak requires further study. In January 2010, Salvato and Salvato (2010e, p. 6) encountered a crab spider, Misumenops bellulus (Aranea: Thomisidae) consuming an early instar leafwing larvae in the Long Pine Key. Because these crab spiders are frequently observed during surveys for Bartram's hairstreaks on pineland croton, they are likely also a major predator of adults and larvae of this species (Salvato and Hennessey 2004, p. 225; M. Salvato, pers. comm. 2006). Salvato and Salvato (2008, p. 342) have observed dragonflies (Odonata) taking adult Bartram's hairstreaks within Long Pine Key. Various birds and lizards are also likely natural predators. Although there are several natural predators, we do not know to what extent predation is a threat to Bartram's hairstreak at this time. Minno and Minno (2009, p. 72) also cite exotic predators such as ants as a major threat. Exotic ants may be a potential threat, but we do not have data indicating that predation by exotic ants is impacting any population at this time.

In summary, it is not known to what extent predation or parasitism may be a threat to the Bartram's hairstreak. Parasitism and predation are a natural part of the life history of the species; studies have documented a wide array of predators and parasitoids. Given the species' low numbers and few occurrences, it is unclear how the Bartram's hairstreak will respond to these factors. Based upon information available, we do not consider this subspecies to be threatened by disease or predation at this time. Disease is not known to be a threat.

D. The inadequacy of existing regulatory mechanisms:

This species is not listed in the State of Florida. Federal, State, and local laws have not been sufficient to prevent past and ongoing impacts to Bartram's hairstreak or its habitat.

A permit is required from the NPS, Service, or County, respectively, for scientific research on and, or collection of the hairstreak at ENP, NKDR, or Miami-Dade Environmental Lands. Although the hairstreak occurs on Federal and County conservation land which offers protection, these areas are vast and open to the public. Public lands can be heavily used, with signage prohibiting collection often lacking and patrolling or monitoring of activities largely absent. Therefore, illegal collection could occur without being detected. Since the hairstreak is not listed by the State, it is not protected from being killed and from unauthorized take if encountered outside of conservation lands. Consequently, the potential for unauthorized or illegal collection of the hairstreak (eggs, larvae, pupae, or adults) exists, as discussed under Factor B above and could go undetected, despite its occurrence on conservation lands.

The 1979 Master Plan is the plan of record for ENP; however the NPS is currently preparing a new General Management Plan for ENP (F. Herling, NPS, pers. comm. 2006). The current plan for ENP indicates one goal as "Natural and cultural resources and associated values are protected, restored and maintained in good condition and managed within their broader ecosystem and cultural context" (NPS 2000, p. 10). However, the Master Plan is not regulatory and its implementation is not mandatory.

In addition to modifying the General Management Plan, ENP is also in the process of updating the park-wide Fire Management Plan (FMP) and Environmental Assessment (EA) (A. Land, pers. comm. 2011). ENP is actively coordinating with Service, as well as other members of the Imperiled Butterfly Working Group (IBWG) to review and adjust the prescribed burn practices outlined in the FMP to help maintain or increase Bartram's hairstreak population sizes, protect pine rocklands, and expand or restore remnant patches of hostplants.

Similarly, the Comprehensive Conservation Plan (CCP) is the principal guiding document for National Wildlife Refuges, and the Service has developed a CCP for NKDR. This plan specifically addresses

strategies for the recovery of the Florida leafwing, Bartram's hairstreak, and Miami blue (Cyclargus thomasi bethunebakeri) (C. Anderson, pers. comm. 2010a). The extent to which NKDR will have the resources necessary to meet its management needs is unknown.

At this time, the protection currently afforded the hairstreak is limited; there is little protection to the species' occupied habitat, and no protection of unoccupied habitat. The current management plan at ENP does not specifically address the hairstreak. Although efforts are underway to improve habitat conditions at ENP, NKDR and County pine rocklands, land management practices do not currently address all of the butterfly's specific life history needs. Therefore, we conclude that existing regulatory mechanisms are inadequate to protect the hairstreak and its habitat, we find that this is a threat of moderate magnitude, but it is imminent.

E. Other natural or manmade factors affecting its continued existence:

Natural or prescribed fire can be a threat to the butterfly. Whereas adults have abilities to move from fire, immature stages (eggs, larvae) are likely to be destroyed by fire (M. Minno, pers. comm. 2009). Large-scale fires (multiple burn blocks) occurring in an extensive area of host plant, fires occurring too frequently, or fires at sensitive times of the species' lifecycle may have serious consequences, given the species' tenuous status. Since few occurrences remain and population size is low, pine rocklands containing known Bartram's hairstreak colonies should not be burned in their entirety during one treatment. In coming years, the ENP will not burn adjacent burn units and not burn units in their entirety (e.g., burning only 50 to 75 percent of a unit, rather than the entire unit) (R. Anderson, NPS, pers. comm. 2011). Prescribed burns are a vital component needed to manage and sustain pine rocklands, as well as to prevent wildfires. However, in general, small, manageable burns may be the most beneficial for the species. Salvato and Hennessey (2004, p. 224) and Salvato and Salvato (2010a, 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. Refugia and corridors with ample areas of host plants and nectar sources should be incorporated into burn plans, wherever possible, and especially in areas of high density butterflies or host plant. Salvato and Hennessey (2004, pp. 223-224) and Salvato and Salvato (2010a, p. 159) indicated that the hairstreak appears to require continuous stands of croton based on its close association with this hostplant.

Minno (pers. comm. 2009) has noticed that Bartram's hairstreaks are most abundant in forested areas with plentiful pineland croton. Minno (pers. comm. 2009) believes that the butterfly does not seem to like large open areas with croton, such as that which resulted following the wildfire that occurred on Big Pine Key in 2009. Anderson (pers. comm. 2010a), however, notes that the butterfly inhabits some non-forested areas on Big Pine Key. Salvato (1999, entire; 2003, p. 53-57) and Salvato and Salvato (2010a, p. 159) reported finding the hairstreak reliably in areas of Big Pine Key that maintained widespread hostplants, such as within firebreaks and forest edges, but found the species to be less frequent where hostplant populations were small or fragmented.

In August 2007, a prescribed burn of approximately 3.6 ha (9 ac) was conducted at Navy Wells in an area occupied by the Bartram's hairstreak. Although present in the footprint of the burn immediately prior to the fire, surveys soon after the burn failed to locate this species (M. Salvato, pers. comm. 2008). A second burn was conducted at Navy Wells in November 2007 on approximately 10.5 ha (26 ac) in pine rocklands adjacent to the previous burn. The butterfly was not encountered in either location post-burn until early spring 2008 (M. Salvato, pers. comm. 2008). However, following the November burn in Navy Wells, the Bartram's hairstreak ultimately re-colonized the treatment area within 3 to 4 months, indicating a faster recovery time than noted for the species elsewhere (Salvato and Salvato 2010a, p. 158). Salvato and Salvato (2010a, p. 158) suggested the small sizes of the prescribed fires conducted at Navy Wells and availability of host plant adjacent to the burns sites may have aided the hairstreak in recolonization of the area. During 2008 through 2010, Salvato (pers. comm. 2010) has frequently encountered adults at Navy Wells, including a high of 12

individuals on May 22, 2010. In addition, croton appears to have responded well to prescribed burns conducted throughout the preserve, with fresh croton growth occurring in many locations (M. Salvato, pers. comm. 2010).

For more than a decade Salvato and Salvato (2010a, pp. 154-160) evaluated Bartram's hairstreak abundance at gate 4 in Long Pine Key during the months prior to and following burn events. These studies found more hairstreaks during the months prior to prescribed burns than after the treatments. For example, during June 2001, much of their gate 4 study area, approximately 540 ha (1,334 ac), was burned and possibly as a result, the hairstreak was not observed again at this location for over 6 months.

ENP is currently monitoring the effects of fire on croton, including hairstreak larvae and adults within study plots (see Monitoring). When croton is growing in areas with favorable topography and fuel loading, burning during wet summer conditions can leave a portion of the host plants unburned (A. Land, pers. comm. 2008). The impacts of fire on the short- and long-term survival of the species is not completely understood (J. Sadle, pers. comm. 2011b). Further research is needed to determine the number of unburned refugia (areas of unburned croton) needed, as well as size of and distance between patches of hostplants.

In years where abundance is especially low, specific areas of occupied habitat may need to be avoided to help safeguard the species over the short- and long-term (S. Perry, pers. comm. 2007; Minno and Minno 2008, p. 1). Fire plans need to be reviewed well in advance of ignition with time to consider any recent changes in butterfly status (S. Perry, pers. comm. 2007). As discussed above (Factor D), ENP is currently in the process of updating its FMP and EA which will access the impacts of fire on various environmental factors, including listed and candidate species. Once the FMP has been finalized it will be examined annually, both internally as well as by outside species experts (A. Land, pers. comm. 2011), so that short-term negative effects from fire (i.e., loss of host plants, loss of eggs and larvae) can be avoided or minimized. Minno and Minno (2008, p. 1) and Salvato and Salvato (2010a, p. 159) suggest that if future management activities are not carefully conducted to include continued cyclic burn patterns, reductions in overall treatment scale, use of adequate refugia within burn-treated areas, or the application of other forms of adaptive management within the LPK fire regime, remaining populations of the species could be depressed further.

As the amount of human activity and size of the human population has increased in south Florida, so has the control of salt marsh mosquitoes (Aedes sollicitans and A. taeniorhynchus). To suppress mosquitoes, second-generation organophosphates (naled) and pyrethroid (permethrin) adulticides are used year-round throughout south Florida and from May to November in the Keys by mosquito control districts (Hennessey et al. 1992, p. 215; Salvato 1999, p. 10). Despite improved mosquito control practices, the use of adulticides, applied using both aerial and ground-based methods to control mosquitoes, present collateral effects on non-target species.

The potential for mosquito control chemicals to drift into non-target areas and persist for varying periods of time has been well 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 Schaus swallowtail and other imperiled species in both the upper (Crocodile Lake NWR, North Key Largo) and lower Keys (NKDR, Big Pine Key). Residues of aerially applied naled were found 6 hours after application in a pineland area that was 820 yards (750 m) from the target area (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 non-target areas but was much less persistent exhibiting a half-life of approximately 6 hours. In 2009, Tim Bargar (U.S. Geological Survey, pers. comm. 2011) conducted two field trials on NKDR that detected significant naled residues at locations within non-target areas on the refuge that were up to 440 yards (402 m) from the edge of zones targeted for aerial applications.

In addition to mosquito control chemicals entering non-target areas, the toxic effects of mosquito control

chemicals to non-target organisms have also been documented. Lethal effects on non-target Lepidoptera have been attributed to fenthion and naled in both south Florida and the Keys (Emmel 1991, pp. 12-13; Eliazar and Emmel 1991, pp. 18-19; Eliazar 1992, pp. 29-30). In the lower Keys, Salvato (2001, pp. 8-14), Salvato and Salvato (2010b, pp. 139-140), and Hennessey and Habeck (1991, p. 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 populations of the Florida leafwing (on Big Pine Key within NKDR) to increase during drier years when adulticide applications over the pinelands decreased, although other butterfly species did not follow this pattern. It is important to note that vulnerability to chemical exposure may vary widely between species, and current application regimes do not appear to affect some species as strongly as others (Calhoun et al. 2002, p. 18; Breidenbaugh and De Szalay 2010, pp. 594-595; Rand and Hoang 2010, pp. 14-17, 20; Hoang et al. 2011, pp. 997-1005).

Dose-dependent decreases in brain cholinesterase activity in great southern white butterflies (Ascia monuste) exposed to naled have been measured in the laboratory (T. Bargar, pers. comm. 2011). An inhibition of cholinesterase, which is the primary mode of action of naled, prevents an important neurotransmitter, acetylcholine, from being metabolized, causing uncontrolled nerve impulses that may result in erratic behavior and, if severe enough, mortality. From these data, it was determined that significant mortality was associated with cholinesterase activity depression of at least 27 percent (T. Bargar, pers. comm. 2011). In a subsequent field study on NKDR, adult great southern white and Gulf fritillary (Agraulis vanillae) butterflies were placed in field enclosures at both target and nontarget areas during aerial naled application. The critical level of cholinesterase inhibition (27 percent) was exceeded in the majority of butterflies from the target areas, as well as in a large proportion of butterflies from the nontarget areas (T. Bargar, pers. comm. 2011). During the same field experiment, great southern white and Gulf fritillary larvae were also exposed in the field during aerial naled application and exhibited mortality at both target and nontarget sites (T. Bargar, pers. comm. 2011).

In a laboratory study, Rand and Hoang (2010, pp. 1-33) and Hoang et al. (2011, pp. 997-1005) examined the effects of exposure to naled, permethrin, and dichlorvos (a breakdown product of naled) on both the adult and larval forms of several native south Florida butterfly species. The results of this study indicated that, in general, larvae were slightly more sensitive to each chemical than adults, but the differences were not significant. Permethrin was generally the most toxic chemical to both larvae and adults, although the sensitivity between species varied. The laboratory toxicity data generated by this study were used to calculate hazard quotients (concentrations in the environment/concentrations causing an adverse effect) to assess the risk that concentrations of naled and permethrin found in the field pose to butterflies. A hazard quotient that exceeds one indicates that the environmental concentration is greater than the concentration known to cause an adverse effect (mortality in this case), thus indicating 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 conducted in the Keys. When using the lowest median lethal concentrations from the laboratory study, the hazard quotients for permethrin were greater than one for each adult butterfly, indicating a significant risk of toxicity to each species. In the case of naled, significant risk to some butterfly species was predicted based on its hazard quotient exceeding one.

From 2006 to 2008, Zhong et al. (2010, pp. 1961-1972) investigated the impact of single aerial applications of naled on larvae of a state-threatened lycaenid, the Miami blue butterfly in the field. The study was conducted in North Key Largo in cooperation with the Florida Keys Mosquito Control District (FKMCD) using laboratory reared Miami blue larvae. The study involved 15 test stations: 9 stations in the target zone, 3 stations considered to be susceptible to drift (two stations directly adjacent to the spray zone and one station 12 miles southwest of the spray zone), and three field reference stations (25 miles southwest of the spray zone). Survival of butterfly larvae in the target zone was 73.9 percent, which was significantly lower than both the drift zone (90.6 percent) and the reference zone (100 percent), indicating that direct exposure to

naled poses significant risk to Miami blue larvae. In addition to observing elevated concentrations of naled at test stations in the target zone, 9 of 18 samples in the drift zone also exhibited detectable concentrations, once again exhibiting the potential for mosquito control chemicals to drift into non-target areas.

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 FKMCD at NKDR have changed to reduce pesticide use over the years. According to the Special Use Permit issued by the Service, the number of aerially applied naled treatments allowed on NKDR has been reduced to a specified allotment (i.e., 9 per mosquito season, no closer than 5 days apart [R. Frakes, Service, pers. comm. 2008]). These changes were made after the Service reviewed the toxicity of naled on federally listed species that occur within NKDR; however, this analysis did not include species of Lepidoptera, since none on NKDR are listed. Since insects are more sensitive to organophosphates than the vertebrate species considered in the analysis, negative impacts to Lepidoptera, including the Bartram's hairstreak, from continued naled applications will likely occur, despite the reduced use of this insecticide. The Service plans to use information from pesticide studies currently underway (see Conservation Measures) to more fully analyze effects to listed species and candidate species on Federal lands.

The small, outlying areas of NKDR have been designated no-spray zones by agreement between the Service and FKMCD. The Service is working towards expanding no-spray zones (A. Morkill, pers. comm. 2010, 2011). However, substantial areas of pine rocklands within NKDR except Watson's Hammock on Big Pine Key are sprayed with naled (aerially applied adulticide); additionally, residential areas and roadsides across Big Pine Key are treated with permethrin (ground-based applied adulticide) (Salvato 2001, p. 10). In short, substantial areas of Big Pine Key, except Watson's Hammock and Cactus Hammock, are sprayed with naled or permethrin. Therefore, the Bartram's hairstreak and its habitat on Big Pine Key are directly exposed to adulticides used for mosquito control. Expansion of no-spray zones may possibly aid the Bartram's hairstreak dispersal within the pine rocklands of Big Pine Key.

In general Long Pine Key does not appear to be regularly impacted by mosquito control practices, except for the use of adulticides (e.g., Sumithrin [Anvil]) in 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 (S. Perry, pers. comm. 2007). Spraying has occurred following hurricanes (S. Perry, pers. comm. 2008). In 2008, however, no spraying was conducted in or near Long Pine Key (S. Perry, pers. comm. 2008). Perry (pers. comm. 2008) believes it is important that spraying does not occur in or near the pinelands or in coastal areas of ENP. Sporadic and localized hairstreak populations, 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.

Butterflies in south Florida and the Keys, such as the Bartram's hairstreak, have adapted over time to the influence of tropical storms and other forms of adverse weather conditions (Salvato and Salvato 2007, p. 154). Salvato and Salvato 2010a (p. 157) encountered several adult hairstreaks shortly after hurricane activity within the Everglades during 2000 and 2005, suggesting the species can recover quickly from the influence of tropical storms. However, given the substantial reduction in the hairstreak's historic range in the past 50 years, the threat and impact of tropical storms and hurricanes on the remaining populations of this species is much greater than when its distribution was more widespread.

In addition, unusually cold temperatures were encountered throughout southern Florida during winters of

2009 and 2010. Sadle (pers. comm. 2009) noted frost damage on croton in Long Pine Key in late 2009, but observed living hairstreak larvae on February 5, 2009, when temperatures were at or barely above freezing (36 degrees F in Homestead and frost on the ground in Long Pine Key). Frost in January 2010 resulted in substantial die back of native plants, including damage and widespread defoliation of pineland croton in Long Pine Key (J. Sadle, pers. comm. 2010a; A. Land, pers. comm. 2010; Hallac et al. 2010, pp. 2-3). Larvae of the imperiled Florida leafwing were impacted by the cold as approximately 50 percent of the individuals were observed to be dead or without nearby food supplies at three locations within Long Pine Key (Hallac et al. 2010, p. 3). Although Salvato and Salvato (unpublished data) did not record increased butterfly larval mortality on their survey sites during early 2010, they did encounter larvae on frost-killed plants. Larvae unable to successfully reach healthier adjacent hostplants likely perished. Sadle (pers. comm. 2011b) and Salvato and Salvato (unpublished data) observed significant leaf and stem damage to pineland croton during December 2010 following subfreezing temperatures. Sadle (pers. comm. 2011b) and Salvato and Salvato (unpublished data) noted living hairstreak larva shortly after the last 2010 freeze in areas largely unaffected by frost. From these observations Sadle (pers. comm. 2011b) suggested that it is possible that frost damage may produce similar effects to loss of above ground plant parts that results from fire. It is not clear what the short or long-term impacts of prolonged cold periods may be on Bartram's hairstreak populations; it is likely that prolonged cold periods have some negative impacts on both the species and its hostplant (J. Sadle, pers. comm. 2010a; A. Land, pers. comm. 2010).

The Bartram's hairstreak is vulnerable to extinction due to populations that are small and isolated. A population of 1,000 has been suggested as marginally viable for an insect, although this is likely highly dependent upon type of species (D. Schweitzer, The Nature Conservancy, pers. comm. 2003). Schweitzer (pers. comm. 2003) has also suggested that butterfly populations of less than 200 adults per generation would have difficulty surviving over the long-term.

In 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 and, 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 Bartram's hairstreak is restricted to a few small, localized populations. Distance between populations and the small size of highly sporadic populations make recolonization unlikely if extirpated. The extent of habitat fragmentation leads us to believe this species is vulnerable due to the small number and size of populations, and their relative isolation.

In summary, the Bartram's hairstreak is vulnerable to a wide array of natural and human factors. Fire can cause mortality of immature stages. Conversely, natural or prescribed fire is a vital component in sustaining pine rockland habitat and the hostplant of the species (A. Land, pers. comm. 2011). Large-scale fires (multiple burn units or without refugia), fires occurring too frequently (e.g., less than 3 years or before recovery), or fires at sensitive times may have severe impacts on the species, given its current status. Although efforts are ongoing to implement fire regimes throughout conservation lands with extant hairstreak populations, we continue to consider the threat of fire to be severe and imminent. Application of mosquito control pesticides are a threat of moderate magnitude to the butterfly outside of ENP. Hurricanes, prolonged cold events, small population size, and few occurrences in a restricted range are also serious threats, given the species' overall vulnerability; overall we find these to be high in magnitude and imminent.

Conservation Measures Planned or Implemented :

Fire management practices on pine rocklands within ENP, Miami-Dade County, and potentially NKDR may provide benefits for the Bartram's hairstreak. The NPS is in the process of mapping pineland croton within ENP (J. Sadle, pers. comm. 2010b) and has established croton monitoring plots (see Monitoring below). The NKDR is mapping areas of croton and expanding its efforts to use prescribed fire. Two burns totaling 4 ha

(10 acres) were burned on NKDR in 2009 (A. Morkill, pers. comm. 2010). Native vegetation, including croton, within these burn plots has responded well to the treatments (C. Anderson, pers. comm. 2010a; Salvato, pers. comm. 2011a). NKDR initiated more intensive surveys for hairstreaks at pine rockland transects across Big Pine Key during 2010 (C. Anderson, pers. comm. 2010c). In addition, Miami-Dade County is working with FTBG to implement a fire monitoring program at its preserves (Possley and Maschinski 2007, pp. 1-13; J. Maguire, pers. comm. 2008b). As part of this program, croton will be mapped and fire effects will be studied (Possley and Maschinski 2007, p. 3; J. Maguire, pers. comm. 2008a).

The Service continues to coordinate a comprehensive laboratory study with Florida International University to refine knowledge of the toxicology and effects of naled and permethrin. Specific objectives of this study are to: (1) determine the toxicity of naled and permethrin to different stages of the life cycle of butterflies at environmentally relevant concentrations of insecticides and (2) conduct a probabilistic ecological risk assessment for butterflies by comparing species sensitivity distributions for naled, dichlorvos, and permethrin with exposure distributions for each insecticide at different sites. The Service has also provided funding to Mote Marine Laboratory to better estimate toxicological effects in the field. Specific objectives of this study are to: (1) determine mosquito adulticide distribution, concentrations, and persistence in the field following routine mosquito control operations and (2) provide empirical data from field studies for comparison with laboratory toxicity studies of mosquito adulticide effects on lepidopteran species. The Service will have a better understanding of the risk to its trust resources by some mosquito control practices following completion of these studies. In addition, the Service is working with the FKMCD in an effort to expand no-spray zones in the Keys. The Service is seeking additional funding to determine the extent of permethrin drift and accumulation within NKDR (A. Morkill, pers. comm. 2009). The NPS is minimizing its use of pesticides in the pinelands and coastal areas of ENP.

The State's Florida Comprehensive Wildlife Conservation Strategy discusses management of pine rocklands, but has not been implemented or funded (FWC 2005, pp. 283-286).

Summary of Threats :

The Bartram's hairstreak occurs at NKDR on Big Pine Key, at Long Pine Key in ENP, and at a few other locations in Miami-Dade County. Habitat of the hairstreak, pine rocklands, is globally imperiled and dependent upon fire. Inappropriate fire management or wildfire could destroy immature stages and impact the availability of pineland croton, its sole host plant. Fire suppression or inability to conduct prescribed fire may also result in loss of habitat. Climatic changes, including sea level rise, are long-term threats that will continue; these factors are expected to impact pine rocklands and ultimately reduce the extent of available habitat, especially in the Keys. In addition, the Bartram's hairstreak and its habitat are vulnerable to a wide variety of natural and human factors. Mosquito control practices are a threat to the population on Big Pine Key and within Miami-Dade County. Small, isolated populations and other sporadic and localized occurrences are exposed to extreme weather events (e.g., hurricanes, prolonged cold temperatures). Further reduction of the populations and associated localized occurrences, especially due to catastrophic weather, pesticide application, loss of suitable habitat, or lack of prescribed fire or inappropriate fire management could severely reduce the likelihood of this butterfly's survival. Finally, we have direct evidence that interest in collection and proposed commercial trade of the Bartram's hairstreak are occurring. Due to the small remaining population size, restricted range, and remoteness of occupied habitat, we believe that collection has the potential to be a serious threat to the subspecies at any time. Even limited collection from the small remaining populations could have deleterious effects on reproductive and genetic viability and thus could contribute to its extinction. We find that this species is warranted for listing throughout all of its range, and, therefore, find that it is unnecessary to analyze whether it is threatened or endangered in a significant portion of its range.

For species that are being removed from candidate status:

_____ Is the removal based in whole or in part on one or more individual conservation efforts that you determined met the standards in the Policy for Evaluation of Conservation Efforts When Making Listing Decisions(PECE)?

Recommended Conservation Measures :

• Continued and additional surveys are needed in Miami-Dade County, ENP, and the Keys.
• Review and adjust fire management practices as needed to help maintain or expand the population sizes or numbers of populations. Continue to seek input on proposed burn plans on an annual basis from species experts. Coordinate activities among fire crews, biologists, and lepidopterists and use adaptive management as needed.
• Protect remnant patches of pine rocklands and use prescribed fire to restore native plant diversity.
• Determine minimum viable population size and develop quantitative population and metapopulation goals for Long Pine Key (and other occurrences). Survey at appropriate intervals to determine if population targets are being met (J. Sadle, pers. comm. 2011b).
• Determine the distribution and abundance of pineland croton within ENP.
• Restore pineland croton to relict fragments of pine rocklands within the hairstreak's historic range to expand its occupied habitat.
• Establish buffer zones with croton as refugia during prescribed fire. Conduct research to assess the efficacy of buffer zones (C. Anderson, pers. comm. 2010; J. Sadle, pers. comm. 2010a). Alternatively, within ENP, conduct burns such that adjacent burn units are not burned at the same time and are not burned in their entirety (e.g., burning only 50 to 75 percent of a unit, rather than the entire unit) (R. Anderson, pers. comm. 2011).
• Address concerns regarding impacts of mosquito control activities in relation to pine rockland habitats on NKDR and adjacent properties. Establish additional no-spray zones and wider buffer areas around these zones.
• Continue to participate and contribute to the IBWG, which is aimed at conserving south Florida's imperiled butterflies.
• Evaluate the need for establishment of ex situ conservation populations in the laboratory (J. Sadle, pers. comm. 2010a). If pursued, ensure that this action is consistent with the Service's captive propagation and reintroduction policy and that adequate funding and support would be available. Previous captive propagation and reintroduction efforts for other imperiled butterflies in Florida have been largely unsuccessful.

Priority Table

Magnitude	Immediacy	Taxonmomy	Priority
High	**Imminent**	Monotypic genus	1
		Species	2
		Subspecies/Population	**3**
	Non-imminent	Monotypic genus	4
		Species	5
		Subspecies/Population	6
Moderate to Low	Imminent	Monotype genus	7
		Species	8
		Subspecies/Population	9
	Non-Imminent	Monotype genus	10
		Species	11
		Subspecies/Population	12

Rationale for Change in Listing Priority Number:

Magnitude:

This butterfly is threatened by the combined influences of habitat destruction and modification from continued loss of unprotected pine rocklands and wildfire or fire management on protected sites. Climatic changes, including sea level rise, are serious long-term threats that will reduce the extent of habitat. Mosquito control activities are a threat to the butterfly on Big Pine Key, including NKDR, and within Miami-Dade County. Loss of genetic diversity may be a problem for the butterfly considering its small, fragmented, and isolated populations. The probability for catastrophic events (e.g., hurricanes, prolonged cold events) and the possibility of accidental harm or habitat destruction are threats due to the small population size and limited numbers at the remaining locations. In addition to these threats, inadequate regulatory protection continues to pose threats to the species throughout its historic range. We also have evidence of interest in collection and proposed commercial trade of the butterfly. Due to the small remaining population size, restricted range, and remoteness of occupied habitat, we believe that collection has the potential to be a serious threat to the species at any time. Even limited collection could have deleterious effects on reproductive and genetic viability and thus could contribute to its extinction. Natural predation and parasitism may now also be threats given the hairstreak's low population size and few occurrences. Overall, we find that these threats are of high magnitude.

Imminence :

The Bartram's hairstreak occurs in only a few locations. The threats of habitat destruction and modification are occurring with the continued loss of unprotected pine rocklands and wildfire or fire management on protected sites. Sea level rise is currently occurring and has resulted in the loss of pine rocklands. However, this is considered a long-term threat since we do not have evidence that it is currently affecting the remaining populations. Mosquito control activities are a threat to the butterfly on Big Pine Key, including NKDR, and within Miami-Dade County. The threat from loss of genetic diversity within small, fragmented, and isolated populations is expected to continue. The likelihood of extreme weather or catastrophic events (e.g., hurricanes, prolonged cold periods) to the remaining populations seriously threatens the survival of this butterfly, and these threats are expected to continue. We find these threats to be currently occurring and

imminent. In addition, we have evidence that interest in collection and proposed commercial sale are ongoing; illicit collection has the potential to occur unnoticed at any time, since areas are remote and open to the public. Overall, we find the immediacy of threats to be imminent.

__Yes__ Have you promptly reviewed all of the information received regarding the species for the purpose of determination whether emergency listing is needed?

Emergency Listing Review

__No__ Is Emergency Listing Warranted?

No, however, status needs to be carefully monitored. The status and distribution of the species needs to be monitored closely to detect change and any further decline. The loss or decline of any occurrence(s) would be detrimental to the status of the species. The Service and its partners need to continue to implement actions to conserve this species, remove threats, and increase viability to the maximum extent possible.

Description of Monitoring:

Surveys for Bartram's hairstreak are ongoing. Monitoring by Salvato began in 1997 and has been conducted either monthly or bi-monthly at various locations within the butterfly's historic range (Salvato 1999, pp. 1-168; 2001, pp. 8-14, pers. comm. 2008). Salvato and Salvato (2010a, pp. 154-160) summarize the species status, ecology, response to prescribed fire and hurricanes, based on their ongoing natural history studies of the species in Long Pine Key. Since 2007, Salvato and Salvato (unpublished data) conducted extensive life history studies on the immature stages of the species to identify parasitism and predators. Surveys by other lepidopterists, agency personnel, and members of the North American Butterfly Association (NABA) occur on a periodic basis.

ENP Fire Management staff initiated fire effects monitoring of pineland croton in 2005. This monitoring effort was started to provide preliminary information on pineland croton and butterfly response to fire for ENP's adaptive management program (A. Land, pers. comm. 2007, 2008). Multiple study plots have been established. Biologists visit each plot monthly to measure pineland croton height and crown area, count the number of flowers and fruits, and to note the presence of eggs, larvae, and herbivory (A. Land, pers. comm. 2007, 2008, 2010). Adults are also recorded if observed within the plot. Monitoring is continuing.

NKDR is monitoring all host plants before and after fire to check for larvae to better understand plant/butterfly response (C. Anderson, pers. comm. 2010a). NKDR initiated more intensive surveys for hairstreaks at pine rockland transects across Big Pine Key during 2010 (C. Anderson, pers. comm. 2010c).

Indicate which State(s) (within the range of the species) provided information or comments on the species or latest species assessment:

Florida

Indicate which State(s) did not provide any information or comment:

none

State Coordination:

The Service requested new information (observations, data, reports) regarding the status of this species and any new information regarding threats to this species from: Florida Department of Agriculture and Consumer Services, Florida Department of Environmental Protection, FWC, U.S. Geological Survey, U.S.

Environmental Protection Agency, National Park Service, Service (Ecological Services and National Wildlife Refuges), FNAI, Archbold Biological Station, IRC, UF, Florida International University, Randolph-Macon College, mosquito control districts, NABA, and other entities. In total, the previous assessment was sent to approximately 116 individuals. New information and data were received from both internal and external sources; few comments were received. All information, data, and comments were incorporated into this assessment.

The Bartram's hairstreak is recognized in Florida's Comprehensive Wildlife Conservation Strategy as one of Florida's species of greatest conservation need (FWC 2005, p. 91).

No new data or comments were received from the State for this assessment. Information and data previously provided have been incorporated into this assessment.

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Approval/Concurrence:

Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve:  06/22/2011
Date

Concur: _____ _____
Date

Did not concur: _____ _____
Date

Director's Remarks:null