(6) It shall not be possible to disarm the immobilization system by interrupting its normal operating voltage.

(7) When the normal starting procedure requires that the disarming device mechanically latch into a receptacle and the device is physically separate from the ignition switch key, one or more motors used for the vehicle's propulsion shall start only after the device is removed from that receptacle.

(8)(i) The immobilization system shall have a minimum capacity of 50,000 code variants, shall not be disarmed by a code that can disarm all other immobilization systems of the same make and model; and

(ii) subject to paragraph (9) of this appendix, it shall not have the capacity to process more than 5,000 codes within 24 hours.

(9) If an immobilization system uses rolling or encrypted codes, it may conform to the following criteria instead of the criteria set out in paragraph (8)(ii) of this appendix:

(i) The probability of obtaining the correct code within 24 hours shall not exceed 4 per cent; and

(ii) It shall not be possible to disarm the system by re-transmitting in any sequence the previous 5 codes generated by the system.

(10) The immobilization system shall be designed so that, when tested as installed in the vehicle neither the replacement of an original immobilization system component with a manufacturer's replacement component nor the addition of a manufacturer's component can be completed without the use of software; and it is not possible for the vehicle to move under its own power for at least 5 minutes after the beginning of the replacement or addition of a component referred to in this paragraph (1).

(11) The immobilization system's conformity to paragraph (10) of this appendix shall be demonstrated by testing that is carried out without damaging the vehicle.

(12) Paragraph (10)(i) of this appendix does not apply to the addition of a disarming device that requires the use of another disarming device that is validated by the immobilization system.

(13) The immobilization system shall be designed so that it can neither be bypassed nor rendered ineffective in a manner that would allow a vehicle to move under its own power, or be disarmed, using one or more of the tools and equipment listed in paragraph (14) of this appendix;

(i) Within a period of less than 5 minutes, when tested as installed in the vehicle; or

(ii) Within a period of less than 2.5 minutes, when bench-tested outside the vehicle.

(14) During a test referred to in paragraph (13) of this appendix, only the following tools or equipment may be used: Scissors, wire strippers, wire cutters and electrical wires, a hammer, a slide hammer, a chisel, a punch, a wrench, a screwdriver, pliers, steel rods and spikes, a hacksaw, a battery operated drill, a battery operated angle grinder; and a battery operated jigsaw.

Note: C.R.C, c. 1038.114, Theft Protection and Rollaway Prevention (in effect March 30, 2011). See: SOR/2011–69 March, 2011 ''Regulations Amending the Motor Vehicle Safety Regulations (Theft Prevention and Rollaway Prevention—Standard 114)'' 2011–03–30 Canada Gazette Part II, Vol 145, No. 7.

Issued in Washington, DC, on September 8, 2016, under authority delegated in 49 CFR part 1.95.

Mark R. Rosekind,

Administrator.

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DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS–R4–ES–2015–0137; 4500030113]

RIN 1018–AZ95

Endangered and Threatened Wildlife and Plants; Endangered Species Status for Chamaecrista lineata var. keyensis (Big Pine Partridge Pea), Chamaesyce deltoidea ssp. serpyllum (Wedge Spurge), and Linum arenicola (Sand Flax), and Threatened Species Status for Argythamnia blodgettii (Blodgett's Silverbush)

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Final rule.

SUMMARY: We, the U.S. Fish and Wildlife Service (Service), determine endangered species status under the Endangered Species Act of 1973 (Act), as amended, for *Chamaecrista lineata* var. *keyensis* (Big Pine partridge pea), *Chamaesyce deltoidea* ssp. *serpyllum* (wedge spurge), and *Linum arenicola* (sand flax), and threatened species status for *Argythamnia blodgettii* (Blodgett's silverbush), all plant species from south Florida. The rule adds these species to the Federal List of Endangered and Threatened Plants.

DATES: This rule is effective October 31, 2016.

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

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

SUPPLEMENTARY INFORMATION:

Executive Summary

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

The basis for our action. Under the Endangered Species Act, we may determine that a species is an endangered or threatened species based on any of five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. We have determined that the threats to *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum, Linum arenicola,* and *Argythamnia blodgettii* consist primarily of:

- Habitat loss and modification through urban and agricultural development, and lack of adequate fire management (Factor A); and
- The proliferation of nonnative, invasive plants; stochastic events (hurricanes and storm surge); maintenance practices used on roadsides and disturbed sites; and sea level rise (Factor E).

Existing regulatory mechanisms have not been adequate to reduce or remove these threats (Factor D).

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

Previous Federal Actions

Please refer to the proposed listing rule for *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum, Linum arenicola,* and

Argythamnia blodgettii (80 FR 58536; September 29, 2015) for a detailed description of previous Federal actions concerning these species.

Background

Please refer to the proposed listing rule (80 FR 58536; September 29, 2015) for the complete discussion of each plant's description, habitat, taxonomy, distribution, population estimates, climate, historical range, current range, status, and biology.

Below, we present only revisions to the discussions in the Background section of the proposed listing rule based on new information from peer review and public comments; as such, not every plant, or every topic for a plant, will be discussed below.

Chamaecrista lineata var. *keyensis* (Big Pine partridge pea)

Species Description

Please refer to the ''Species Description'' section of the proposed rule for the complete discussion. We make one minor editorial revision to our description of the plant's fruit, as follows: The fruit is an elongate pod, roughly similar to that of a pea, 33–45 millimeters (mm) (1.3–1.8 inches (in)) long and 4.5–5.0 mm (0.19–0.17 in) wide, with a soft fuzzy texture, which turns gray with age and eventually splits open to release seeds (Irwin and Barneby 1982, p. 757; Small 1933, pp. 662–663).

Habitat

Please refer to the ''Habitat'' section of the proposed rule for the complete discussion. In the *Pine Rocklands* discussion, we correct the following names of species: *Quercus elliottii* (running oak) is corrected to *Quercus elliottii* (running oak), and *Psidium longipes* (longstalked stopper) is corrected to *Psidium longipes* (longstalked stopper). We also correct the reference to hardwoods in the pine rocklands of the lower Florida Keys; the hardwoods in the subcanopy include species such as *Byrsonima lucida* and *Mosiera longipes* (Bradley 2006, p. 3).

Current Range, Population Estimates, and Status

Please refer to the ''Current Range, Population Estimates, and Status'' section of the proposed rule for the complete discussion. We make minor editorial revisions to the first sentence of the third paragraph of that section, as follows: A second indicator, the frequency with which *Chamaecrista lineata* var. *keyensis* occurred in sample plots on Big Pine Key from data collected in 2005, 2007, and 2013, also shows a decline.

Linum arenicola (sand flax)

Habitat

Please refer to the ''Habitat'' section of the proposed rule for the complete discussion. Under *Roadsides and Other Disturbed Sites,* we make minor editorial corrections concerning the plant's persistence on roadsides, as follows: *Linum arenicola* was at one time more common in pine rocklands in Miami-Dade County, but a lack of periodic fires in most pine rocklands fragments over the last century has pushed this species into the more sunny, artificial environments it prefers (Bradley and Gann 1999, p. 61).

Please refer to the ''Current Range, Population Estimates, and Status'' section of the proposed rule for the complete discussion. We make the following corrections to that discussion:

(1) We correct the description of the current distribution of *Linum arenicola* in Miami-Dade County, as follows: In Miami-Dade County, the current distribution of *Linum arenicola* is from just north of SW 184 Street (in the Martinez Pinelands Preserve), south to the intersection of Card Sound Road and the C–102 canal, and west to SW 264 Street and 177 Avenue (Everglades Archery Range at Camp Owaissa Bauer).

(2) We correct our description of the compilation of all survey work to include a missed citation for Possley (2016, pers. comm.). The corrected sentence reads: Based on a compilation of all survey work through 2016, including Austin (1980), Kernan and Bradley (1996, pp. 1–30), Bradley and Gann (1999, pp. 61–65), Hodges and Bradley (2006, pp. 37–41), Bradley and Saha (2009, p. 10), Bradley (2009, p. 3), Hodges (2010, pp. 4–5, 15), Bradley and van der Heiden (2013, pp. 6–12, 19), Bradley *et al.* (2015, pp. 28–29), and Possley (2016, pers. comm.), of 26 historical population records for *Linum arenicola,* 12 populations are extant and 14 are extirpated (see Table 3), a loss of roughly 54 percent of known populations, from the early 1900s to the present.

(3) Under *Miami-Dade County,* we correct the location of the seventh population of *Linum arenicola,* as follows: A seventh small population, located in 2014 at Zoo Miami, (Possley 2016, pers. comm.) is located on county land.

(4) As a result of the corrections described in (1) through (3), above, we present a revised version of the proposed rule's Table 3 (note: in the following table, USFWS stands for U.S. Fish and Wildlife Service; FWC stands for Florida Fish and Wildlife Conservation Commission; HARB stands for Homestead Air Reserve Base; and SOCSOUTH stands for Special Operations Command South Headquarters):

TABLE 3—SUMMARY OF THE STATUS AND TRENDS OF THE KNOWN OCCURRENCES OF *Linum arenicola*

Population	Ownership	Most Recent Population Estimate	County	Trend
Extant 12 records				
Big Pine Key	USFWS, FWC, TNC [12], Private.	2,676 (2007) [1]	Monroe	declining.
Upper Sugarloaf Key	FDOT [13], USFWS	73 (2010) [2]	Monroe	insufficient data.
Lower Sugarloaf Key	FDOT [13], USFWS	531 (2010) [2]	Monroe	stable.
Big Torch Key	FDOT [13], Private	1 (2010) [2]	Monroe	declining.
Zoo Miami	Miami-Dade County	56 (2014) [5]	Miami-Dade	insufficient data.
Martinez Pineland	Miami-Dade County	100–200 (2013) [6]	Miami-Dade	insufficient data.
Everglades Archery Range	Miami-Dade County	23 (2012) [7]	Miami-Dade	insufficient data.
HAFB [15] 1—S of Naizare BLVD	DOD [14], Miami-Dade County.	24,000 (2013) [7]	Miami-Dade	stable.
SOCSOUTH (HAFB 2—NW side of Bikini BLVD).	DOD [14] (leased from Miami-Dade County).	74,000 (2009) [7 10]	Miami-Dade	stable.
HARB (SW 288 St. and 132 Ave)	DOD [14]	37 (2011) [7]	Miami-Dade	insufficient data.
C–102 Canal SW 248 St. to U.S. 1	SFWMD [11]	1,000–10,000 (2013) [7]	Miami-Dade	insufficient data.

TABLE 3—SUMMARY OF THE STATUS AND TRENDS OF THE KNOWN OCCURRENCES OF *Linum arenicola*—Continued

Population	Ownership	Most Recent Population Estimate	County	Trend
L–31E canal, from SW 328 St. to Card Sound Road.	SFWMD[11]	Plants occur along 14 km (8.7 mi) of levee (2013)[7].	Miami-Dade	insufficient data.
Extirpated 14 records				
Middle Torch Key	FWC, FDOT[13]	3 (2005)[3]	Monroe.	
Ramrod Key	FDOT[13]	110 (1979)[4]	Monroe.	
Park Key	FDOT[13]	unknown (1961)[3]	Monroe.	
Boca Chica	DOD[14], other (unknown).	unknown (1912)[3]	Monroe.	
Camp Jackson	unknown	unknown (1907)[9]	Miami-Dade.	
Big Hammock Prairie	unknown	unknown (1911)[9]	Miami-Dade.	
Camp Owaissa Bauer	Miami-Dade County	10 (1983)[7]	Miami-Dade.	
Allapatah Drive and Old Cutler Road	Private	256 (1996)[8]	Miami-Dade.	
Bauer Drive (Country Ridge Estates)	Miami-Dade County	8 (1996)[8]	Miami-Dade.	
Silver Green Cemetery	Private	47 (1996)[8]	Miami-Dade.	
Palmetto Bay Village Center	Private	12 (1996)[8]	Miami-Dade.	
HAFB (Community Partnership Drive)	DOD[14], Miami-Dade County.	unknown (2010)[7]	Miami-Dade.	
Coco Plum Circle (corner of Robles Street & Vista Mar Street).	Private	75 (1996)[8]	Miami-Dade.	
George Avery Pineland Preserve	Private	''small colony'' (2002)[7]	Miami-Dade.	

[1] Bradley and Saha 2009, p. 10.
[2] Hodges 2010, p. 10.
[3] Hodges and Bradley 2006, pp. 39–48.
[4] Austin *et al.* 1980 in FNAI.
[5] Possley 2016, pers. comm., p. 11.
[6] Possley 2014, pers. comm.
[7] Bradley and Van Der Heiden 2013, pp. 6–11.
[8] Kernan and Bradley 1996, p. 9.
[9] Bradley and Gann 1999, p. 65.
[10] Bradley 2009, p. 3.
[11] South Florida Water Management District (SFWMD).
[12] The Nature Conservancy (TNC).
[13] Florida Department of Transportation (FDOT).
[14] Department of Defense (DOD).
[15] Homestead Air Force Base (HAFB; decommissioned).

Biology

Please refer to the ''Biology'' section of the proposed rule for the complete discussion.

We revise the *Life History and Reproduction* discussion to read:

Life History and Reproduction: Little is known about the life history of *Linum arenicola,* including pollination biology, seed production, or dispersal. Reproduction is sexual, with new plants generated from seeds. *L. arenicola* is apparently self-compatible (Harris 2016, pers. comm.). The species produces flowers nearly year round, with maximum flowering from April to September, with a peak around March and April. *L. arenicola* population demographics or longevity have not been studied (Bradley and Gann, 1999, p. 65; Hodges and Bradley 2006, p. 41; Hodges 2007, p. 2; Harris 2016, pers. comm.).

Argythamnia blodgettii (Blodgett's silverbush)

Species Description

Please refer to the ''Species Description'' section of the proposed rule for the complete discussion. We clarify the description of the leaves of *Argythamnia blodgettii,* as follows: The leaves, arranged alternately along the stems, are 1.5 to 4.0 centimeters (cm) (0.6 to 1.6 in) long, have smooth (or rarely toothed) edges, are oval or elliptic in shape, and often are colored a distinctive, metallic bluish green when dried.

Taxonomy

Please refer to the ''Taxonomy'' section of the proposed rule for the complete discussion.

To the end of the first paragraph, we add the following: Ingram (1952) indicates the distribution of *Argythamnia argothamnoides* (including Florida material) as Florida and Venezuela. As such, the Service accepts the treatment of *Argythamnia blodgettii* as a distinct species and therefore does not find a compelling justification to remove the species from consideration for listing under the Act.

Current Range, Population Estimates, and Status

Please refer to the ''Current Range, Population Estimates, and Status'' section of the proposed rule for the complete discussion. We make the following corrections to that discussion:

(1) We correct the data in Table 4, presented below. (Note: In the following table, USFWS stands for U.S. Fish and Wildlife Service; FWC stands for Florida Fish and Wildlife Conservation Commission; DOD stands for Department of Defense; and ENP stands for Everglades National Park.)

(2) Because of the corrections presented below for Table 4, the text preceding the table in the proposed rule is now incorrect. Based on the data presented below in Table 4, there are 50 records for *Argythamnia blodgettii* in Miami-Dade and Monroe Counties. Twenty populations are extant, 15 are extirpated, and the status of 15 is uncertain because they have not been surveyed in 15 years or more.

TABLE 4—SUMMARY OF THE STATUS AND TRENDS OF THE KNOWN OCCURRENCES OF *Argythamnia blodgettii*

Population	Ownership	Most recent population estimate	County	Trend
Extant 20 records				
Plantation Key, Snake Creek Hammock	FWC	101–1,000 (2005) [2]	Monroe	Insufficient data.
Lower Matecumbe Key—Klopp Tract	FDEP [6]	11–100 (2000) [2]	Monroe	Insufficient data.
Lignumvitae Key	FDEP [6]	101–1,000 (2005) [2]	Monroe	Insufficient data.
Big Munson Island	Private (Boy Scouts of America).	1,001–10,000 (2005) [2]	Monroe	Insufficient data.
North Key Largo	DOD, FDOT	No estimate (2005) [8]	Monroe	Insufficient data.
Key Largo—Dove Creek Hammock	FWC, FDOT	11–100 (2005) [2]	Monroe	Insufficient data.
Vaca Key (Marathon)—Blue Heron Hammock.	FWC, FDOT	11–100 (2005) [2]	Monroe	Insufficient data.
Windley Key—State Park	FDEP [6]	11–100 (2005) [2]	Monroe	Insufficient data.
Boca Chica KWNAS [7] Runway 25	DOD	1,001–10,000 (2004) [2]	Monroe	Insufficient data.
Boca Chica Key KWNAS [7] Weapons Hammock.	DOD	200 (2004) [2]	Monroe	Insufficient data.
Big Pine Key	USFWS, FWC, private.	~2,200 (2005) [2]	Monroe	Insufficient data.
ENP Long Pine Key Deer Hammock area (Pine Block A), Turkey Hammock area (Pine Block B), Pine Block E.	NPS [5]	2,000 (2015) [4]	Miami-Dade	Insufficient data.
Fuch's Hammock	Miami-Dade County	12 (2008) [1]	Miami-Dade	Insufficient data.
Owaissa Bauer Addition	Miami Dade Parks and Recreation.	377 (2014) [9]	Miami-Dade	Insufficient data.
Camp Owaissa Bauer	Miami Dade Parks and Recreation.	878 (2009) [9]	Miami-Dade	Insufficient data.
Ned Glenn Pineland Preserve	Miami Dade Parks and Recreation.	8 (2016) [10]	Miami-Dade	Insufficient data.
Camp Choee	Private (Girl Scout Council of Tropical Florida).	3 (2005) [3]	Miami-Dade	Insufficient data.
Florida Power and Light Easement adjacent to Ludlam Preserve.	Private	7 (2015) [9]	Miami-Dade	Insufficient data.
Larry and Penny Thompson Park	Miami Dade Parks and Recreation.	5,700 (2009) [9]	Miami-Dade	Insufficient data.
Boystown Pineland	Private	No estimate (2005) [3]	Miami-Dade	Insufficient data.
Uncertain 15 records				
Crawl Key, Forestiera Hammock	Private	10 (1982) [3]	Monroe	Insufficient data.
Long Key State Park	FDEP	No estimate (1999) [2]	Monroe	Insufficient data.
Stock Island	Private	No estimate (1981) [2]	Monroe	Insufficient data.
Boot Key	Private	11–100 (1998) [2]	Monroe	Insufficient data.
Deering Estate	State of Florida	11–100 (1991) [1]	Miami-Dade	Insufficient data.
Castellow Hammock	Miami Dade Parks and Recreation.	11–100 (1991) [1]	Miami-Dade	Insufficient data.
Pine Ridge Sanctuary	Private	2–10 (1992) [1]	Miami-Dade	Insufficient data.
County Ridge Estates	Private	11–100 (1999) [1]	Miami-Dade	Insufficient data.
Epmore Drive pineland	Private	2–10 (1999) [1]	Miami-Dade	Insufficient data.
Gifford Arboretum Pineland	Private	2–10 (1999) [1]	Miami-Dade	Insufficient data.
Ned Glenn Nature Preserve	Miami Dade Parks and Recreation.	11–100 (1999) [1]	Miami-Dade	Insufficient data.
Natural Forest Community #317	Private	2–10 (1999) [1]	Miami-Dade	Insufficient data.
Old Dixie pineland	Private	11–100 (1999) [1]	Miami-Dade	Insufficient data.
Castellow #33	Private	12 (1995) [3]	Miami-Dade	Insufficient data.
Castellow #31	Private	30 –50 (1995) [3]	Miami-Dade	Insufficient data.
Extirpated 15 records				
Upper Matecumbe Key	unknown	No estimate (1967) [3]	Monroe.	
Totten Key	NPS	No estimate (1904) [1]	Monroe.	
Key West	City of Key West	No estimate (1965) [1]	Monroe.	
SW 184th St. and 83rd Ave.	Private	0 (2016) [10]	Miami-Dade	Insufficient data.
Tropical Park Pineland	Miami Dade Parks and Recreation.	0 (2016) [9]	Miami-Dade.	
Crandon Park—Key Biscayne	Miami Dade Parks and Recreation.	0 (2008) [9]	Miami-Dade.	
Brickell Hammock	unknown	Extirpated 1937 [1]	Miami-Dade.	
Carribean Park	Miami-Dade County	Extirpated 1998 [1]	Miami-Dade.	
Coconut Grove	Miami-Dade County	Extirpated 1901 [1]	Miami-Dade.	
Coral Gables area	unknown	Extirpated 1967 [1]	Miami-Dade.	
Miller and 72nd Ave	unknown	Extirpated 1975 [1]	Miami-Dade.	

TABLE 4—SUMMARY OF THE STATUS AND TRENDS OF THE KNOWN OCCURRENCES OF *Argythamnia blodgettii*—Continued

Population	Ownership	Most recent population estimate	County	Trend
Orchid Jungle	Miami-Dade County	Extirpated 1930 [1]	Miami-Dade.	
Palms Woodlawn Cemetery	Private	Extirpated 1992 [1]	Miami-Dade.	
South of Miami River	unknown	Extirpated 1913 [1]	Miami-Dade.	
Naranja	Private	No estimate (1974) [3]	Miami-Dade.	

[1] Bradley and Gann 1999, p. 6.
[2] Hodges and Bradley 2006, pp. 10–17.
[3] FNAI 2011b.
[4] Sadle 2015, pers. comm., p. 1.
[5] National Park Service (NPS).
[6] Florida Department of Environmental Protection (FDEP).
[7] Key West Naval Air Station (KWNAS).
[8] Henize and Hipes 2005, p. 25.
[9] Possley 2016, pers. comm.
[10] Lange 2016, pers. comm.

Summary of Comments and Recommendations

In the proposed rule published on September 29, 2015 (80 FR 58536), we requested that all interested parties submit written comments on the proposal by November 30, 2015. We also contacted appropriate Federal and State agencies, scientific experts and organizations, and other interested parties and invited them to comment on the proposal. Newspaper notices inviting general public comment were published in the Miami Herald and Key West Citizen. We did not receive any requests for a public hearing. All substantive information provided during the comment period has either been incorporated directly into this final determination or is addressed below.

Peer Reviewer Comments

In accordance with our peer review policy published on July 1, 1994 (59 FR 34270), we solicited expert opinion from three knowledgeable individuals with scientific expertise that included familiarity with *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum, Linum arenicola,* and *Argythamnia blodgettii* and their habitats, biological needs, and threats. We received responses from all three peer reviewers.

We reviewed all comments received from the peer reviewers for substantive issues and new information regarding the listing of *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum, Linum arenicola,* and *Argythamnia blodgettii.* The peer reviewers generally concurred with our methods and conclusions, and provided additional information, clarifications, and suggestions to improve this final rule.

(1) *Comment:* One peer reviewer and one public commenter provided new information about the status of various populations of *Linum arenicola* and *Argythamnia blodgettii* within Miami-Dade County preserves. The peer reviewer suggested that the Service may be overestimating the number of extant populations of *A. blodgettii,* referring to outdated data for Tropical Park, Martinez Preserve, and Crandon Park. The reviewer also suggested the rule should identify the separate parcels within the Richmond Pinelands complex (*i.e.,* Ram Development Corporation, Martinez Pineland Preserve, Larry and Penny Thompson Park, Zoo Miami, University of Florida, and those owned by the Department of Defense (DOD)).

Our Response: The Service appreciates the new information. We have updated the tables, and associated text, summarizing the status and trends of the known occurrences of *Linum arenicola* and *Argythamnia blodgettii* (Tables 3 and 4, above).

(2) *Comment:* Two peer reviewers and one public commenter identified a recent publication by Ramirez-Amezcua and Steinman (2013) that included a treatment of the *Argythamnia* subgenus *Ditaxis* in Mexico, stating that the range of *A. argothamnoides* includes Florida, which may bring into question the validity of *A. blodgettii* as a valid taxon. One reviewer concluded that after reading the published information on the subject, he did not find compelling information to suggest that Florida *A. blodgettii* populations are synonymous with *Argythamnia* spp. outside of Florida. This reviewer also recommended that the Service treat *A. blodgettii* as a distinct species, endemic to Florida.

Our Response: The Service has reviewed Ramirez-Amezcua and Steinman (2013) and additional literature relating to the taxonomy of *Argythamnia blodgettii.* As stated in the ''Taxonomy'' sections of this rule and the proposed rule, there is a history of changes to the classification of this plant, with many based on studies that do not include samples from across the plant's range, including the recent publication suggesting that *Argythamnia blodgettii* is synonymous with the wider ranging *Ditaxis argothamnoides.* However, the Service accepts the treatment of *A. blodgettii* as a distinct species and therefore does not find a compelling justification to remove the species from consideration for listing under the Act.

(3) *Comment:* One reviewer commented on the need to include information about genetic studies in the document.

Our Response: No genetic studies of *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum, Linum arenicola,* or *Argythamnia blodgettii* have been conducted.

(4) *Comment:* One reviewer disagreed with our statement that there is no regulatory protection for State-listed plants on private lands through Florida Administrative Code (FAC) 5B–40.

Our Response: The Service apologizes for mischaracterizing the regulatory protections provided through FAC 5B–40. We have corrected this, and describe the protections in detail in this final rule under *Factor D. The Inadequacy of Existing Regulatory Mechanisms,* below.

(5) *Comment:* One reviewer suggested future research in best practices for mowing areas that support *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum, Linum arenicola,* and *Argythamnia blodgettii.*

Our Response: The Service agrees that the best mowing practices should be investigated to support the species. This is a topic that will be addressed in the recovery planning process.

(6) *Comment:* One reviewer provided new information from an ongoing study about the direct and indirect effects of mosquito insecticide spray on flower visitors and reproductive fitness of *Chamaecrista lineata* var. *keyensis* and *Linum arenicola* in the lower Florida Keys. In addition, two public commenters took issue with the section of the proposed rule that discussed mosquito control pesticide applications as a factor affecting pollinators of *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum, Linum arenicola,* and *Argythamnia blodgettii.* They asserted that the Service made incorrect statements regarding the frequency and amount of mosquito control adulticide treatments in South Florida. These public commenters requested that any mention of pesticide effects on pollinators be removed from this final rule.

Our Response: The Service appreciates the new information provided by the peer reviewer. Data from ongoing studies in the lower Florida Keys of *L. arenicola* flower visitor observations show that sites not treated with adulticides had slightly higher fruit set rates than treated sites and pollinator-excluded experimental trials. Several species of small bees were observed frequenting flowers at untreated sites, while visitation was much less frequent at the treated site. Extensive studies in the Florida Keys suggest that broad spectrum insecticides negatively affect nontarget invertebrates, including pollinators (Hennessey 1991; Eliazar and Emmel 1991; Kevan *et al.* 1997; Salvato 2001; Bargar 2011; Hoang *et al.* 2011). In addition, pesticides have been shown to drift into adjacent undisturbed habitat that serves as a refuge for native biota (Hennessey 1992; Pierce *et al.* 2005; Zhong *et al.* 2010; Bargar 2011). These pesticides can be fatal to nontarget invertebrates that move between urban and forest habitats, altering ecological processes within forest communities (Kevan and Plowright 1989, 1995; Liu and Koptur 2003).

The Service believes that pesticide spraying may be a factor affecting the reproductive success of *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum, Linum arenicola,* and *Argythamnia blodgettii.* However, we acknowledge that pesticide spraying practices by the Florida Keys Mosquito Control District (FKMCD) at National Key Deer Refuge (NKDR) have changed over the years to reduce pesticide use. Since 2003, expanded larvicide treatments to surrounding islands have significantly reduced adulticide use on Big Pine Key, No Name Key, and the Torch Keys. In addition, the number of aerially applied naled (Dibrom®) treatments allowed on NKDR has been limited since 2008 (FKMCD 2012, pp. 10–11). Zones that include the core habitat used by pine rockland butterflies, and several linear miles of pine rocklands habitat within the Refuge-neighborhood interface, were excluded from truck spray applications (no-spray zones) (Anderson 2012, pers. comm.; Service 2012, p. 32). These exclusions and buffer zones encompass over 95 percent of extant croton distribution on Big Pine Key, and include the majority of known recent and historical Florida leafwing population centers on the island (Salvato 2012, pers. comm.).

Accordingly, the Service commends the FKMCD for its cooperation in recovering endangered butterflies and plants. Nevertheless, we are proceeding cautiously and have initiated a multi-year research project to further investigate the level of impact pesticides have on these four plants.

Federal Agency Comments

(7) *Comment:* The U.S. Navy expressed interest and a commitment to work proactively with the Service to coordinate on the proposed listing of *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum, Linum arenicola,* and *Argythamnia blodgettii* under the Act. Naval Air Station (NAS) Key West, Florida, is subject to the NAS Key West Integrated Natural Resources Management Plan (INRMP). The Navy noted that the NAS Key West INRMP was acknowledged in the proposed listing rule as providing a conservation benefit to *Argythamnia blodgettii* habitat. The 2013 INRMP update identified several Monroe County rare species, including *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum,* and *Linum arenicola,* that do not occur on NAS Key West properties. The Navy requested that the Service coordinate with it prior to proposing critical habitat on Navy land for any of these species and to fully consider the benefits imparted to these species through INRMP implementation.

Our Response: We appreciate the U.S. Navy's interest and commitment to work proactively with the Service to conserve *Argythamnia blodgettii.* In particular, NAS Key West has been proactive in surveying for these species and updating the NAS Key West INRMP to include conservation measures for *Argythamnia blodgettii.* The Service will coordinate early with NAS Key West regarding any critical habitat proposal for *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum, Linum arenicola,* or *Argythamnia blodgettii.*

Comments From the State

We received comments from a peer reviewer who is employed by the Florida Forest Service. Those comments are addressed above under *Peer Reviewer Comments* in our responses to Comments (3) and (4).

Public Comments

(8) *Comment:* One commenter opposed the proposed listing of the plants on Big Pine Key, Florida. While the commenter generally agreed with the field data for the *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum, Linum arenicola,* and *Argythamnia blodgettii,* the commenter asserted the habitat can no longer sustain these and other federally protected endangered species going forward. The commenter described several alterations, including drainage canals and shallow wells for drainage, that they asserted have permanently damaged the freshwater lens (convex layer of groundwater on top of a layer of denser saltwater) in the Florida Keys. These alterations and sea level rise have permanently changed the natural lens and the amount of freshwater available to these species, particularly in times of drought or following a major hurricane event.

Our Response: The Service acknowledges the challenges faced by the Florida Keys due to salinization and sea level rise. These factors are discussed at length in this final rule under *Factor E. Other Natural or Manmade Factors Affecting Its Continued Existence,* below. In addition, the Service agrees habitat loss or degradation is a factor that threatens *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum, Linum arenicola,* and *Argythamnia blodgettii.* However, we disagree that habitat on Big Pine Key can no longer sustain these or other federally protected endangered species going forward. Canals, which occur throughout a large portion of Big Pine Key, have allowed saltwater intrusion into upland areas of the island for decades, threatening upland ecosystems. However, habitat restoration is ongoing across Big Pine Key, particularly within the pine rocklands and rockland hammocks. These restoration efforts are attempting to protect the freshwater lens required by native vegetation; this includes filling or plugging drainage canals to reduce or halt seawater intrusion into upland areas.

Summary of Changes From the Proposed Rule

None of the new information we received during the comment period on the proposed rule changes our determinations in this final rule for these four plants. Most of the changes are editorial in nature, and are described above in the **Background** section of this rule. However, based on comments we received from peer reviewers and the public, we make the following substantive changes:

- We update the status of several populations of *Linum arenicola* and *Argythamnia blodgettii;*
- We update the discussion of the taxonomy of *A. blodgettii* to take into consideration a recent publication; and
- We update our discussion of pesticide applications and pollinators to reflect current application limitations now in effect on Big Pine Key.

Summary of Factors Affecting the Species

The Act directs us to determine whether any species is an endangered species or a threatened species because of any one of five factors affecting its continued existence. In this section, we summarize the biological condition of each of the plant species and its resources, and the factors affecting them, to assess the species' overall viability and the risks to that viability.

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

Chamaecrista lineata var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum, Linum arenicola,* and *Argythamnia blodgettii* have experienced substantial destruction, modification, and curtailment of their habitats and ranges. Specific threats to these plants under this factor include habitat loss, fragmentation, and modification caused by development (*i.e.,* conversion to both urban and agricultural land uses) and inadequate fire management. Each of these threats and its specific effects on these plants are discussed in detail below.

Human Population Growth, Development, and Agricultural Conversion

The modification and destruction of the habitats that support *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum, Linum arenicola,* and *Argythamnia blodgettii* has been extreme in most areas of Miami-Dade and Monroe Counties, thereby reducing these plants' current ranges and abundance in Florida. The pine rocklands community of south Florida, in which all four plants primarily occur, is critically imperiled locally and globally (FNAI 2012, p. 27). Destruction of pine rocklands and rockland hammocks has occurred since the beginning of the 1900s. Extensive land clearing for human population growth, development, and agriculture in Miami-Dade and Monroe Counties has altered, degraded, or destroyed thousands of acres of these once abundant ecosystems.

In Miami-Dade County, development and agriculture have reduced pine rocklands habitat by 90 percent in mainland south Florida. Pine rocklands habitat decreased from approximately 74,000 hectares (ha) (183,000 acres (ac)) in the early 1900s, to only 8,140 ha (20,100 ac) in 1996 (Kernan and Bradley 1996, p. 2). The largest remaining intact pine rocklands (approximately 2,313 ha (5,716 ac)) is located on Long Pine Key in Everglades National Park (ENP). Outside of ENP, only about 1 percent of the pine rocklands on the Miami Rock Ridge have escaped clearing, and much of what is left are small remnants scattered throughout the Miami metropolitan area, isolated from other natural areas (Herndon 1998, p. 1).

Similarly, most of the pine rocklands in the Florida Keys (Monroe County) have been impacted (Hodges and Bradley 2006, p. 6). Pine rocklands historically covered 1,049 ha (2,592 ac) of Big Pine Key (Folk 1991, p. 188), the largest area of pine rocklands in the Florida Keys. Pine rocklands now cover approximately 582 ha (1,438 ac) of the island, a reduction of 56 percent (Bradley and Saha 2009, p. 3). There were no estimates of pine rocklands area on the other islands historically, but each contained much smaller amounts of the habitat than Big Pine Key. Remaining pine rocklands on Cudjoe Key cover 72 ha (178 ac), Little Pine has 53 ha (131 ac), No Name has 56 ha (138 ac), and Sugarloaf has 38 ha (94 ac). The total area of remaining pine rocklands in the Florida Keys is approximately 801 ha (1,979 ac). Currently, about 478 ha (1,181 ac) (82 percent) of the pine rocklands on Big Pine Key, and most of the pine rocklands on these other islands, are protected within the NKDR and properties owned by the Nature Conservancy, the State of Florida, and Monroe County (Bradley and Saha 2009, pp. 3–4). Based on the data presented above, the total remaining acreage of pine rocklands in Miami-Dade and Monroe Counties is now 8,981 ha (22,079 ac) (approximately 8,140 ha (20,100 ac) in Miami-Dade County, and 801 ha (1,979 ac) in the Florida Keys (Monroe County)).

The marl prairies that also support *Linum arenicola* have similarly been destroyed by the rapid development of Miami-Dade and Monroe Counties. At least some of the occurrences reported from this habitat may be the result of colonization that occurred after they were artificially dried-out due to local or regional drainage.

Likewise, habitat modification and destruction from residential and commercial development have severely impacted rockland hammocks, and coastal berm, that support *Argythamnia blodgettii.* Rockland hammocks were once abundant in Miami-Dade and Monroe Counties but are now considered imperiled locally and globally (FNAI 2010x, pp. 24–26). The tremendous development and agricultural pressures in south Florida have resulted in significant reductions of rockland hammock, which is also susceptible to fire, frost, hurricane damage, and groundwater reduction (Phillips 1940, p. 167; Snyder *et al.* 1990, pp. 271–272; FNAI 2010, pp. 24–26).

Pine rocklands, rockland hammock, marl prairie, and coastal habitats on private land remain vulnerable to development, which could lead to the loss of populations of these four species. As noted earlier, all four plants have been impacted by development. The sites of Small's 1907 and 1911 *L. arenicola* collections in Miami-Dade County are now agricultural fields (Kernan and Bradley 1996, p. 4). A pine rocklands site that supported *L. arenicola* on Vistalmar Street in Coral Gables (Miami-Dade County) was cleared and developed in 2005, as part of the growing the Cocoplum housing development. A second pine rocklands site that supported *L. arenicola,* located on private land on Old Cutler Road, was developed into the Palmetto Bay Village Center. *L. arenicola* has not been observed at either site since they were developed. A former marl prairie site supporting a sizable population of *L. arenicola* near Old Cutler Road and Allapatah Drive (SW 112 Ave) in Miami-Dade County was extirpated when the site was developed in the 1990s (Bradley and van der Heiden 2013, pp. 6–12, 19). The Boca Chica Key population of *L. arenicola* was also likely lost due to development (Hodges and Bradley 2006, p. 48).

Bradley and Gann (1999, p. 6) list 12 populations of *Argythamnia blodgettii* in Miami-Dade County that were lost when the site that supported them was developed. An *A. blodgettii* population on Key West was likely lost due to the near complete urbanization of the island (Hodges and Bradley 2006, p. 43). Any

development related to the Boy Scout camp on Big Munson Island is a potential threat to the largest population *A. blodgettii.*

The largest *Linum arenicola* population in Miami-Dade County is located on property owned by the Miami-Dade County Homeless Trust. U.S. Special Operations Command South Headquarters (SOCSOUTH), a unified command of all four services of DOD, has entered into a 50-year agreement with Miami-Dade County to lease this 90-ac (36.4-ha) area, where they are building a permanent headquarters on approximately 28 ac (11.3 ha) (DOD 2009, p. 1). As stated above, the population of *L. arenicola* is spread across the site and was estimated at 74,000 plants in 2009 (Bradley 2009, p. 3). In consultation with the Service, the DOD developed a plan that avoided the majority of the population with accompanying protection and management of approximately 57,725 individuals of sand flax (about 78 percent of the estimated onsite population) (Service 2011, p. 13). The plan will manage 5.95 ha (14.7 ac) of habitat, though most of it is scraped, and only a small portion has a pine canopy (Van der Heiden and Johnson 2013, p. 2). An additional 1.3 ha (3.2 ac) is being managed and supports 13,184 individuals of sand flax (about 18 percent of the estimated onsite population) (Service 2011, p. 13).

Currently there are plans to develop a 55-ha (137-ac) privately-owned portion of the largest remaining area of pine rocklands habitat in Miami-Dade County, the Richmond pine rocklands, with a shopping center and residential construction (RAM 2014, p. 2). Bradley and Gann (1999, p. 4) called the 345-ha (853-ac) Richmond pine rocklands, ''the largest and most important area of pine rockland in Miami-Dade County outside of Everglades National Park.'' Populations of *Argythamnia blodgettii* and *Linum arenicola,* along with numerous federally listed species, occur in habitat adjacent to the area slated for development. The Miami-Dade County Department of Regulatory and Economic Resources (RER) has completed a management plan for county-owned portions of the Richmond pine rocklands (Martinez Pineland Preserve, Larry and Penny Thompson Park) under a grant from the Service and is leading the restoration and management of these areas (Bradley and Gann 1999, p. 4). The developer has proposed to enter into a habitat conservation plan in conjunction with their plans to develop their portion of the site and was required by Miami-Dade County Natural Forest Community (NFC) regulations to set aside and manage 15 ha (39 ac) of pine rocklands and 2 ha (4 ac) of rockland hammock. A second project that would result in the loss of pine rocklands habitat is also proposed for the Richmond pine rocklands. It includes expanding the Miami Zoo complex to develop an amusement park and large retail mall.

Approximately 25 percent of extant *Linum arenicola* occurrences (3 of 12 sites), and 40 percent of extant *Argythamnia blodgettii* occurrences (14 of 35 sites), are located on private land; no extant populations of *Chamaecrista lineata* var. *keyensis* or *Chamaesyce deltoidea* ssp. *serpyllum* are located entirely on private land. It is possible that the plants on private lands will be lost from most of these sites in the future with increased pressure from development and the other threats described below.

Argythamnia blodgettii is the only one of the four plant species that occurs in ENP, where a population of over 2,000 plants is stable, and prescribed fire and other management activities that benefit *A. blodgettii* are conducted on a regular basis.

Most pine rocklands and rockland hammock habitat is now limited to public conservation lands, where future development and habitat alteration are less likely than on private lands. However, public lands could be sold off (or leased) in the future and become more likely to be developed or altered in a way that negatively impacts the habitat. For example, at the SOCSOUTH site noted above (leased to DOD by Miami-Dade County), ongoing development of headquarters buildings SOCSOUTH has resulted in the loss of *L. arenicola* and pine rocklands habitat (Bradley and van der Heiden 2013, pp. 8–10). Construction of visitor facilities such as parking lots, roads, trails, and buildings can result in habitat loss on public lands that are set aside as preserves or parks.

Roadside populations of *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum, Linum arenicola,* and *Argythamnia blodgettii* are vulnerable to habitat loss and modification stemming from infrastructure projects such as road widening, and installation of underground cable, sewer, and water lines. The Lower Sugarloaf Key population of *Linum arenicola* was impacted by repaving of the road, which placed asphalt on top of and adjacent to the population (Hodges and Bradley 2006, p. 41).

Although no entire populations of *Chamaecrista lineata* var. *keyensis* or *Chamaesyce deltoidea* ssp. *serpyllum* have been extirpated by habitat loss due to development, the size and extent of these populations have been reduced on Big Pine Key (and surrounding islands for *Chamaecrista lineata* var. *keyensis*). The total area of pine rocklands on Big Pine Key has decreased by 56 percent from 1955 to the present (Bradley and Saha 2009, p. 3).

The human population within Miami-Dade County is currently greater than 2.4 million people, and is expected to grow to more than 4 million by 2060, an annual increase of roughly 30,000 people (Zwick and Carr 2006, p. 20). Overall, the human population in Monroe County is expected to increase from 79,589 to more than 92,287 people by 2060 (Zwick and Carr 2006, p. 21). All vacant land in the Florida Keys is projected to be developed by then, including lands currently inaccessible for development, such as islands not attached to the Overseas Highway (U.S. 1) (Zwick and Carr 2006, p. 14). However, in an effort to address the impact of development on federally listed species, Monroe County implemented a habitat conservation plan (HCP) for Big Pine and No Name Keys in 2006. In order to fulfill the HCP's mitigation requirements, the County has been actively acquiring parcels of high-quality pine rocklands, such as The Nature Conservancy's 20-acre Terrestris Tract on Big Pine Key, and managing them for conservation. Although the HCP has helped to limit the impact of development, land development pressure and habitat losses may resume when the HCP expires in 2023. If the HCP is not renewed, residential or commercial development could increase to pre-HCP levels.

While Miami-Dade and Monroe County both have developed a network of public conservation lands that include pine rocklands, rockland hammocks, marl prairies, and coastal habitats, much of the remaining habitat occurs on private lands as well as publicly owned lands not managed for conservation. Species occurrences and suitable habitat remaining on these lands are threatened by habitat loss and degradation, and threats are expected to accelerate with increased development. Further losses will seriously affect the four plant species' ability to persist in the wild and decrease the possibility of their recovery or recolonization.

Habitat Fragmentation

The remaining pine rocklands in the Miami metropolitan area are severely fragmented and isolated from each other by vast areas of development. Remaining pine rockland areas in the Florida Keys are fragmented and are located on small islands separated by

ocean. Habitat fragmentation reduces the size of plant populations and increases spatial isolation of remnants. Barrios *et al.* (2011, p. 1062) investigated the effects of fragmentation on a pine rocklands plant, *Angadenia berteroi* (pineland golden trumpet), which is recognized by the State of Florida as threatened, and found that abundance and fragment size were positively related. Possley *et al.* (2008, p. 385) studied the effects of fragment size on species composition in south Florida pine rocklands, and found that plant species richness and fragment size were positively correlated (although some small fragments supported nearly as many species as the largest fragment). Composition of fragmented habitat typically differs from that of intact forests; as isolation and edge effects increase, there is increased abundance of disturbance-adapted species (weedy species; nonnative, invasive species) and lower rates of pollination and propagule dispersal (Laurence and Bierregaard 1997, pp. 347–350; Noss and Csuti 1997, pp. 284–299). The degree to which fragmentation threatens the dispersal abilities of *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum, Linum arenicola,* and *Argythamnia blodgettii* is unknown. In the historical landscape, where pine rocklands occurred within a mosaic of wetlands, water may have acted as a dispersal vector for all pine rocklands seeds. In the current, fragmented landscape, this type of dispersal would no longer be possible for any of the Miami-Dade populations. While additional dispersal vectors may include animals and (in certain locations) mowing equipment, it is likely that fragmentation has effectively reduced these plants' ability to disperse and exchange genetic material.

While pollination research has not been conducted for *Chamaesyce deltoidea* ssp. *serpyllum, Linum arenicola,* and *Argythamnia blodgettii,* research regarding other species and ecosystems, including *Chamaecrista lineata* var. *keyensis* (discussed below), provides valuable information regarding potential effects of fragmentation on these plants. Effects of fragmentation on pollinators may include changes to the pollinator community as a result of limitation of pollinator-required resources (*e.g.,* reduced availability of rendezvous plants, nesting and roosting sites, and nectar/pollen); these changes may include changes to pollinator community composition, species abundance and diversity, and pollinator behavior (Rathcke and Jules 1993, pp. 273–275; Kremen and Ricketts 2000, p. 1227; Harris and Johnson 2004, pp. 30–33). As a result, plants in fragmented habitats may experience lower visitation rates, which in turn may result in reduced seed production of the pollinated plant (which may lead to reduced seedling recruitment), reduced pollen dispersal, increased inbreeding, reduced genetic variability, and ultimately reduced population viability (Rathcke and Jules 1993, p. 275; Goverde *et al.* 2002, pp. 297–298; Harris and Johnson 2004, pp. 33–34).

In addition to affecting pollination, fragmentation of natural habitats often alters other ecosystems' functions and disturbance regimes. Fragmentation results in an increased proportion of ''edge'' habitat, which in turn has a variety of effects, including changes in microclimate and community structure at various distances from the edge (Margules and Pressey 2000, p. 248), altered spatial distribution of fire (greater fire frequency in areas nearer the edge) (Cochrane 2001, pp. 1518–1519), and increased pressure from nonnative, invasive plants and animals that may out-compete or disturb native plant populations. Liu and Koptur (2003, p. 1184) reported decreases in *Chamaecrista lineata* var. *keyensis's* seed production in urban areas of Big Pine Key due to increased seed predation, compared with areas away from development.

The effects of fragmentation on fire go beyond edge effects and include reduced likelihood and extent of fires, and altered behavior and characteristics (*e.g.,* intensity) of those fires that do occur. Habitat fragmentation encourages the suppression of naturally occurring fires, and has prevented fire from moving across the landscape in a natural way, resulting in an increased amount of habitat suffering from these negative impacts. High fragmentation of small habitat patches within an urban matrix discourages the use of prescribed fire as well due to logistical difficulties (see ''Fire Management,'' below). Forest fragments in urban settings are also subject to increased likelihood of certain types of human-related disturbance, such as the dumping of trash (Chavez and Tynon 2000, p. 405). The many effects of habitat fragmentation may work in concert to threaten the local persistence of a species; when a species' range of occurrence is limited, threats to local persistence increase extinction risk.

Fire Management

One of the primary threats to *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum, Linum arenicola,* and *Argythamnia blodgettii* is habitat modification and degradation through inadequate fire management, which includes both the lack of prescribed fire and suppression of natural fires. Where the term ''fire-suppressed'' is used below, it describes degraded pine rocklands conditions resulting from a lack of adequate fire (natural or prescribed) in the landscape. Historically, frequent (approximately twice per decade), lightning-induced fires were a vital component in maintaining native vegetation and ecosystem functioning within south Florida pine rocklands. A period of just 10 years without fire may result in a marked decrease in the number of herbaceous species due to the effects of shading and litter accumulation (FNAI 2010, p. 63). Exclusion of fire for approximately 25 years will likely result in gradual hammock development over that time period, leaving a system that is very fire-resistant if additional pre-fire management (*e.g.,* mechanical hardwood removal) is not undertaken.

Today, natural fires are unlikely to occur or are likely to be suppressed in the remaining, highly fragmented pine rocklands habitat. The suppression of natural fires has reduced the size of the areas that burn, and habitat fragmentation has prevented fire from moving across the landscape in a natural way. Without fire, successional climax from pine rocklands to rockland hammock is rapid, and displacement of native species by invasive, nonnative plants often occurs. Understory plants such as *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum, Linum arenicola,* and *Argythamnia blodgettii* are shaded out by hardwoods and nonnatives alike. Shading may also be caused by a fire-suppressed pine canopy that has evaded the natural thinning effects that fire has on seedlings and smaller trees. Whether the dense canopy is composed of pine, hardwoods, nonnatives, or a combination, seed germination and establishment are inhibited in fire-suppressed habitat due to accumulated leaf litter, which also changes soil moisture and nutrient availability (Hiers *et al.* 2007, pp. 811–812). This alteration to microhabitat can also inhibit seedling establishment as well as negatively influence flower and fruit production (Wendelberger and Maschinski 2009, pp. 849–851), thereby reducing sexual reproduction in fire-adapted species such as *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum, L. arenicola,* and *A. blodgettii* (Geiger 2002, pp. 78–79, 81–83).

After an extended period of inadequate fire management in pine

rocklands, it becomes necessary to control invading native hardwoods mechanically, as excess growth of native hardwoods would result in a hot fire, which can kill mature pines. Mechanical treatments cannot entirely replace fire because pine trees, understory shrubs, grasses, and herbs all contribute to an ever-increasing layer of leaf litter, covering herbs and preventing germination, as discussed above. Leaf litter will continue to accumulate even if hardwoods are removed mechanically. In addition, the ashes left by fires provide important post-fire nutrient cycling, which is not provided via mechanical removal.

Federal (Service, NPS, FFS (Florida Forest Service)), State (FDEP, FWC), and County land managers (Miami-Dade RER and NAM (the Natural Areas Management division of Department of Parks, Recreation and Open Spaces), and nonprofit organizations (Institute for Regional Conservation (IRC), The Nature Conservancy (TNC)) implement prescribed fire on public and private lands within the ranges of these four plants. While management of some County conservation lands includes regular burning, other lands remain severely fire-suppressed. Even in areas under active management, some portions are typically fire-suppressed.

Miami-Dade County: Implementation of a prescribed fire program in Miami-Dade County has been hampered by a shortage of resources, as well as by logistical difficulties and public concern related to burning next to residential areas. Many homes have been built in a mosaic of pine rocklands, so the use of prescribed fire in many places has become complicated because of potential danger to structures and smoke generated from the burns. Nonprofit organizations such as IRC have similar difficulties in conducting prescribed burns due to difficulties with permitting and obtaining the necessary permissions as well as hazard insurance limitations (Gann 2013a, pers. comm.). Few private landowners have the means or desire to implement prescribed fire on their property, and doing so in a fragmented urban environment is logistically difficult and may be costly.

All occurrences of *Linum arenicola* and *Argythamnia blodgettii* in Miami-Dade County are affected by some degree of inadequate fire management of pine rocklands and marl prairie habitat, with the primary threat being the modification and loss of habitat due to an increase in shrub and hardwood dominance, eliminating suitable conditions for the four plants, and eventual succession to rockland hammock.

In Miami-Dade County, *Linum arenicola* occurred along the south edge of Bauer Drive on the northern border of a pine rockland owned by Miami-Dade County. The property is occupied by a communications tower, and is not a managed preserve. Kernan and Bradley (1996) reported eight plants. At the time (1992 through 1996), the road shoulder was dominated by native grasses. Since then, native canopy hardwoods have invaded the site and eliminated the sunny conditions required by *L. arenicola.* It has not been seen since, despite multiple surveys between 1997 and 2012, and is considered to be extirpated. *L. arenicola* was discovered at Camp Owaissa Bauer by George N. Avery in 1983. Since that time, the pine rocklands habitat where he found the plants in the park suffered extremely heavy hardwood recruitment due to fire suppression. Despite recent hardwood control and reintroduction of fire, no plants have been relocated. Bradley and Gann (1999, pp. 71–72) suggested that the lack of fires in most forest fragments in Miami-Dade County during the last century may be one of the reasons why *L. arenicola* occurs primarily in disturbed areas.

Monroe County (Florida Keys): Fire management of pine rocklands of the lower Florida Keys, most of which are within NKDR, is hampered by a shortage of resources, technical challenges, and expense of conducting prescribed fire in a matrix of public and private ownership. Residential and commercial properties are embedded within or in close proximity to pine rocklands habitat (Snyder *et al.* 2005, p. 2; C. Anderson 2012a, pers. comm.). As a result, hand or mechanical vegetation management may be necessary at select locations on Big Pine Key (Emmel *et al.* 1995, p. 11; Minno 2009, pers. comm.; Service 2010, pp. 1–68) to maintain or restore pine rocklands. Mechanical treatments may be less beneficial than fire because they do not quickly convert debris to nutrients, and remaining leaf litter may suppress seedling development; fire has also been found to stimulate seedling germination (C. Anderson 2010, pers. comm.). Because mechanical treatments may not provide the same ecological benefits as fire, NKDR continues to focus efforts on conducting prescribed fire where possible (C. Anderson 2012a, pers. comm.). However, the majority of pine rocklands within NKDR are several years behind the ideal fire return interval (5–7 years) suggested for this ecosystem (Synder *et al.* 2005, p. 2; Bradley and Saha 2011, pp. 1–16). Tree ring and sediment data show that pine rocklands in the lower Keys have burned at least every 5 years and sometimes up to three times per decade historically (Albritton 2009, p. 123; Horn *et al.* 2013, pp. 1–67; Harley 2012, pp. 1–246). From 1985 to 1992, prescribed burns were conducted in the NKDR mainly for fuel reduction. There was no prescribed burning by Service staff in the NKDR from 1992–1997, in part because not enough was known about the ecological effects of prescribed fire in this system (Snyder *et al.* 1990, p. 2).

All occurrences of *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum, Linum arenicola,* and *Argythamnia blodgettii* in the Florida Keys are affected by some degree of inadequate fire management of pine rocklands habitat, with the primary threat being the modification and loss of habitat due to an increase in shrub and hardwood dominance, eliminating suitable conditions for the four plants, and eventual succession to rockland hammock.

Prescribed fire management over the past decade has not been sufficient to reverse long-term declines in *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum,* or *Linum arenicola* on Big Pine Key. Prescribed fire activity on Big Pine Key and adjacent islands within NKDR appears to be insufficient to prevent loss of pine rocklands habitat (Carlson *et al.* 1993, p. 914; Bergh and Wisby 1996, pp. 1–2; O'Brien 1998, p. 209; Bradley and Saha 2009, pp. 28–29; Bradley *et al.* 2011, pp. 1–16). As a result, many of the pine rocklands across NKDR are being compromised by succession to rockland hammock (Bradley and Saha 2009, pp. 28–29; Bradley *et al.* 2011, pp. 1–16).

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

Miami-Dade County Environmentally Endangered Lands (EEL) Covenant Program: In 1979, Miami-Dade County enacted the Environmentally Endangered Lands (EEL) Covenant Program, which reduces taxes for private landowners of natural forest communities (NFCs; pine rocklands and tropical hardwood hammocks) who agree not to develop their property and manage it for a period of 10 years, with the option to renew for additional 10-year periods (Service 1999, p. 3–177). Although these temporary conservation easements provide valuable protection for their duration, they are not considered under the discussion of Factor D, below, because they are voluntary agreements and not regulatory

in nature. Miami-Dade County currently has approximately 59 pine rocklands properties enrolled in this program, preserving 69.4 ha (172 ac) of pine rocklands habitat (Johnson 2012, pers. comm.). The program also has approximately 21 rockland hammocks properties enrolled in this program, preserving 20.64 ha (51 ac) of rockland hammock habitat (Joyner 2013b, pers. comm.). The vast majority of these properties are small, and many are in need of habitat management such as prescribed fire and removal of nonnative, invasive plants. Thus, while EEL covenant lands have the potential to provide valuable habitat for these plants and reduce threats in the near term, the actual effect of these conservation lands is largely determined by whether individual landowners follow prescribed EEL management plans and NFC regulations (see ''Local'' under Factor D discussion, below).

Fee Title Properties: In 1990, Miami-Dade County voters approved a 2-year property tax to fund the acquisition, protection, and maintenance of natural areas by the EEL Program. The EEL Program purchases and manages natural lands for preservation. Land uses deemed incompatible with the protection of the natural resources are prohibited by current regulations; however, the County Commission ultimately controls what may happen with any County property, and land use changes may occur over time (Gil 2013b, pers. comm.). To date, the Miami-Dade County EEL Program has acquired a total of approximately 313 ha (775 ac) of pine rocklands, and 95 ha (236 ac) of rockland hammocks (Guerra 2015, pers. comm.; Gil 2013b, pers. comm.). The EEL Program also manages approximately 314 ha (777 ac) of pine rocklands, and 639 ha (1,578 ac) of tropical hardwood and rockland hammocks owned by the Miami-Dade County Parks, Recreation and Open Spaces Department, including some of the largest remaining areas of pine rocklands habitat on the Miami Rock Ridge outside of ENP (*e.g.,* Larry and Penny Thompson Park, Zoo Miami pinelands, Navy Wells Pineland Preserve), and some of the largest remaining areas of tropical hardwood and rockland hammocks (*e.g.,* Matheson Hammock Park, Castellow Hammock Park, Deering Estate Park and Preserves).

Conservation efforts in Miami's EEL Preserves have been underway for many years. In Miami-Dade County, conservation lands are and have been monitored by Fairchild Tropical Botanic Garden (FTBG) and IRC, in coordination with the EEL Program, to assess habitat status and determine any changes that may pose a threat to or alter the abundance of these species. Impacts to habitat *(e.g.,* canopy) via nonnative species and natural stochastic events are monitored and actively managed in areas where the taxon is known to occur. These programs are long-term and ongoing in Miami-Dade County; however, programs are limited by the availability of annual funding.

Since 2005, the Service has funded IRC to facilitate restoration and management of privately owned pine rocklands habitats in Miami-Dade County. These programs included prescribed burns, nonnative plant control, light debris removal, hardwood management, reintroduction of pines where needed, and development of management plans. One of these programs, called the Pine Rockland Initiative, includes 10-year cooperative agreements between participating landowners and the Service/IRC to ensure restored areas will be managed appropriately during that time. Although most of these objectives have been achieved, IRC has not been able to conduct the desired prescribed burns, due to logistical difficulties as discussed earlier (see ''Fire Management,'' above).

Connect to Protect Program: FTBG, with the support of various Federal, State, and local agencies and nonprofit organizations, has established the ''Connect to Protect Network.'' The objective of this program is to encourage widespread participation of citizens to create corridors of healthy pine rocklands by planting stepping stone gardens and rights-of-way with native pine rocklands species, and restoring isolated pine rocklands fragments. By doing this, FTBG hopes to increase the probability that pollination and seed dispersal vectors can find and transport seeds and pollen across developed areas that separate pine rocklands fragments to improve gene flow between fragmented plant populations and increase the likelihood that these plants will persist over the long term. Although these projects may serve as valuable components toward the conservation of pine rocklands species and habitat, they are dependent on continual funding, as well as participation from private landowners, both of which may vary through time.

National Wildlife Refuges: The National Wildlife Refuge System Improvement Act of 1997 (16 U.S.C. 668dd note) and the Fish and Wildlife Service Manual (601 FW 3, 602 FW 3) require maintaining biological integrity and diversity, require comprehensive conservation planning for each refuge, and set standards to ensure that all uses of refuges are compatible with their purposes and the Refuge System's wildlife conservation mission. The comprehensive conservation plans (CCPs) address conservation of fish, wildlife, and plant resources and their related habitats, while providing opportunities for compatible wildlife-dependent recreation uses. An overriding consideration reflected in these plans is that fish and wildlife conservation has first priority in refuge management, and that public use be allowed and encouraged as long as it is compatible with, or does not detract from, the Refuge System mission and refuge purpose(s). The CCP for the Lower Florida Keys National Wildlife Refuges (NKDR, Key West National Wildlife Refuge, and Great White Heron National Wildlife Refuge) provides a description of the environment and priority resource issues that were considered in developing the objectives and strategies that guide management over the next 15 years. The CCP promotes the enhancement of wildlife populations by maintaining and enhancing a diversity and abundance of habitats for native plants and animals, especially imperiled species that are found only in the Florida Keys. The CCP also provides for obtaining baseline data and monitoring indicator species to detect changes in ecosystem diversity and integrity related to climate change. The CCP provides specifically for maintaining and expanding populations of candidate plant species, including *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum, Linum arenicola,* and *Argythamnia blodgettii,* all four of which are found in this refuge complex.

Department of Defense Lands: The Sikes Act requires the DOD to develop and implement integrated natural resources management plans (INRMPs) for military installations across the United States (see also Factor D discussion, below). INRMPs are prepared in cooperation with the Service and State fish and wildlife agencies to ensure proper consideration of fish, wildlife, and habitat needs. The DOD has an approved INRMP for Key West Naval Air Station (KWNAS) on Boca Chica Key that includes measures that will protect and enhance *Argythamnia blodgettii* habitat, including nonnative species control (DOD 2014, p. 69). Furthermore, DOD is currently preparing an INRMP for Homestead Air Reserve Base (HARB) and SOCSOUTH. A previous biological opinion (Service 2011, entire) required SOCSOUTH to protect and manage 7.4 ha (18.3 ac) of pine rocklands habitat

and 70,909 individuals of *Linum arenicola* (approximately 96 percent of the estimated onsite population) based on 2009 survey data. A conservation easement was established over the protected areas, and DOD has provided funds for management of the site, including fencing and nonnative species control.

Summary of Factor A

We have identified a number of threats to the habitat of *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum, Linum arenicola,* and *Argythamnia blodgettii* that have operated in the past, are impacting these species now, and will continue to impact them in the future. Habitat loss, fragmentation, and degradation, and associated pressures from increased human population, are major threats; these threats are expected to continue, placing these plants at greater risk. All four plants may be impacted when pine rocklands are converted to other uses or when lack of fire causes the conversion to hardwood hammocks or other unsuitable habitat conditions. Any populations of these species found on private property could be destroyed by development; the limited pine rocklands, rockland hammock, and coastal berm habitat on public lands can also be affected by development of recreational facilities or infrastructure projects. Although efforts are being made to conserve publicly and privately owned natural areas and apply prescribed fire, the long-term effects of large-scale and wide-ranging habitat modification, destruction, and curtailment will last into the future, while ongoing habitat loss due to population growth, development, and agricultural conversion continues to pose a threat. Therefore, based on the best information available, we have determined that the threats to the four plants from habitat destruction, modification, or curtailment are occurring throughout the entire range of the species and are expected to continue into the future.

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

The best available data do not indicate that overutilization for commercial, recreational, scientific, or educational purposes is a threat to *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum, Linum arenicola,* or *Argythamnia blodgettii.* Threats to these plants related to other aspects of recreation and similar human activities (*i.e.,* not related to overutilization) are discussed under Factor E, below.

Factor C. Disease or Predation

No diseases or incidences of predation have been reported for *Chamaesyce deltoidea* ssp. *serpyllum* or *Argythamnia blodgettii.*

Key deer are known to occasional browse plants indiscriminately, including *Chamaecrista lineata* var. *keyensis* and *Linum arenicola.* Key deer do not appear to feed on *Argythamnia blodgettii,* probably due to potential toxicity (Hodges and Bradley 2006, p. 19).

Seed predation by an insect occurs in *Chamaecrista lineata* var. *keyensis,* and seems to be exacerbated by habitat fragmentation. Individuals at the urban edge suffer higher insect seed predation than those inside the forest (Liu and Koptur 2003, p. 1184).

While seed predation and occasional Key deer browsing may be a stressor, they do not appear to rise to the level of threat at this time. Therefore, the best available data do not indicate that disease or predation is a threat to *Chamaecrista lineata* var. *keyensis* or *Linum arenicola.*

Factor D. The Inadequacy of Existing Regulatory Mechanisms

Under this factor, we examine whether threats to these plants are discussed under the other factors are continuing due to an inadequacy of an existing regulatory mechanism. Section 4(b)(1)(A) of the Act requires the Service to take into account ''those efforts, if any, being made by any State or foreign nation, or any political subdivision of a State or foreign nation, to protect such species.'' In relation to Factor D under the Act, we interpret this language to require the Service to consider relevant Federal, State, and tribal laws, regulations, and other such mechanisms that may minimize any of the threats we describe in threat analyses under the other four factors, or otherwise enhance conservation of the species. We give strongest weight to statutes and their implementing regulations and to management direction that stems from those laws and regulations. Examples are State governmental actions enforced under a State statute or constitution, and Federal actions authorized by statute.

Having evaluated the impact of the threats as mitigated by any such conservation efforts, we analyze under Factor D the extent to which existing regulatory mechanisms are inadequate to address the specific threats to the species. Regulatory mechanisms, if they exist, may reduce or eliminate the impacts from one or more identified threats. In this section, we review existing Federal, State, and local regulatory mechanisms to determine whether they effectively reduce or remove threats to *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum, Linum arenicola,* and *Argythamnia blodgettii.*

Federal

As Federal candidate species, the four plants are afforded some protection through sections 7 and 10 of the Act and associated policies and guidelines. Service policy requires that candidate species be treated as proposed species for purposes of intra-Service consultations and conferences where the Service's actions may affect candidate species. Other Federal action agencies (*e.g.,* NPS) are to consider the potential effects (*e.g.,* prescribed fire, pesticide treatments) to these plants and their habitat during the consultation and conference process. Applicants and Federal action agencies are encouraged to consider candidate species when seeking incidental take for other listed species and when developing habitat conservation plans. However, candidate species do not receive the same level of protection that a listed species does under the Act.

Populations of *Argythamnia blodgettii* within ENP are protected by NPS regulations at 36 CFR 2.1, which prohibit visitors from harming or removing plants, listed or otherwise, from ENP. However, the regulations do not address actions taken by NPS that cause habitat loss or modification.

As discussed above under Factor A, the CCPs for the Lower Florida Keys National Wildlife Refuge and the Crocodile Lake National Wildlife Refuge provide for *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum, Linum arenicola,* and *Argythamnia blodgettii. Linum arenicola* occurs on DOD lands at HARB and SOCSOUTH. *L. arenicola* and *A. blodgettii* may occur on Federal lands within the Richmond Pine rocklands, including lands owned by the U.S. Coast Guard.

As discussed under Factor A, above, the DOD has an approved INRMP for KWNAS on Boca Chica Key that includes measures that will protect and enhance *Argythamnia blodgettii* habitat, including nonnative species control (DOD 2014, p. 69). Furthermore, as also discussed above, DOD is currently preparing an INRMP for HARB and SOCSOUTH, and a 2011 Service biological opinion requires SOCSOUTH to protect and manage 7.4 ha (18.3 ac)

of pine rocklands habitat and 70,909 individuals of *Linum arenicola.*

However, certain populations of the four plants occur on State- or county-owned properties, and development of these areas will likely require no Federal permit or other authorization. Therefore, projects that affect the plants on State- and county-owned lands do not have Federal oversight, such as complying with the National Environmental Policy Act (NEPA; 42 U.S.C. 4321 *et seq.*), unless the project has a Federal nexus (Federal funding, permits, or other authorizations). Therefore, the four plants have no direct Federal regulatory protection in these areas.

State

Chamaecrista lineata var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum, Linum arenicola,* and *Argythamnia blodgettii* are listed on the Regulated Plant Index (Index) as endangered under chapter 5B–40, Florida Administrative Code. This listing provides little or no habitat protection beyond the State's development of a regional impact process, which discloses impacts from projects, but provides only limited regulatory protection for State-listed plants on private lands.

Florida Statutes 581.185 sections (3)(a) and (3)(b) prohibit any person from willfully destroying or harvesting any species listed as endangered or threatened on the Index, or growing such a plant on the private land of another, or on any public land, without first obtaining the written permission of the landowner and a permit from the Florida Department of Plant Industry. The statute further provides that any person willfully destroying or harvesting; transporting, carrying, or conveying on any public road or highway; or selling or offering for sale any plant listed in the Index as endangered must have a permit from the State at all times when engaged in any such activities. Further, Florida Statutes 581.185 section (10) provides for consultation similar to section 7 of the Act for listed species, by requiring the Department of Transportation to notify the Florida Department of Agriculture and Consumer Services and the Endangered Plant Advisory Council of planned highway construction at the time bids are first advertised, to facilitate evaluation of the project for listed plant populations, and to provide ''for the appropriate disposal of such plants'' (*i.e.,* transplanting).

However, this statute provides no substantive protection of habitat or protection of potentially suitable habitat at this time. Florida Statutes 581.185 section (8) waives State regulation for certain classes of activities for all species on the Index, including the clearing or removal of regulated plants for agricultural, forestry, mining, construction (residential, commercial, or infrastructure), and fire-control activities by a private landowner or his or her agent.

Local

In 1984, section 24–49 of the Code of Miami-Dade County established regulation of County-designated NFCs. These regulations were placed on specific properties throughout the County by an act of the Board of County Commissioners in an effort to protect environmentally sensitive forest lands. The Miami-Dade County RER has regulatory authority over these County-designated NFCs and is charged with enforcing regulations that provide partial protection of remaining upland forested areas designated as NFC on the Miami Rock Ridge. NFC regulations are designed to prevent clearing or destruction of native vegetation within preserved areas. Miami-Dade County Code typically allows up to 20 percent of pine rocklands designated as NFC to be developed, and requires that the remaining 80 percent be placed under a perpetual covenant. The code requires that no more than 10 percent of a rockland hammock designated as NFC may be developed for properties greater than 5 acres and that the remaining 90 percent be placed under a perpetual covenant for preservation purposes (Joyner 2013a, 2014, pers. comm.; Lima 2014, pers. comm.). However, for properties less than 5 acres, up to one-half an acre may be cleared if the request is deemed a reasonable use of property; this allowance often may be greater than 20 percent (for pine rocklands) or 10 percent (for rockland hammock) of the property (Lima 2014, pers. comm.). NFC landowners are also required to obtain an NFC permit for any work, including removal of nonnatives within the boundaries of the NFC on their property. When RER discovers unpermitted work, it takes appropriate enforcement action and seeks restoration when possible. The NFC program is responsible for ensuring that NFC permits are issued in accordance with the limitations and requirements of the county code and that appropriate NFC preserves are established and maintained in conjunction with the issuance of an NFC permit when development occurs. The NFC program currently regulates approximately 600 pine rocklands or pine rocklands/hammock properties, comprising approximately 1,200 ha (3,000 ac) of habitat (Joyner 2013, pers. comm.).

Although the NFC program is designed to protect rare and important upland (non-wetlands) habitats in south Florida, the strategy has limitations. For example, in certain circumstances where landowners can demonstrate that limiting development to 20 percent (for pine rocklands) or 10 percent (for rockland hammock) does not allow for ''reasonable use'' of the property, additional development may be approved. Furthermore, Miami-Dade County Code provides for up to 100 percent of the NFC to be developed in limited circumstances for parcels less than 2.02 ha (5 ac) in size and only requires coordination with landowners if they plan to develop property or perform work within the NFC-designated area. Therefore, many of the existing private forested NFC parcels remain fragmented, without management obligations or preserve designation, as development has not been proposed at a level that would trigger the NFC regulatory requirements. Often, nonnative vegetation over time begins to dominate and degrade the undeveloped and unmanaged NFC landscape until it no longer meets the legal threshold of an NFC, which applies only to land dominated by native vegetation. When development of such degraded NFCs is proposed, Miami-Dade County Code requires delisting of the degraded areas as part of the development process. Property previously designated as NFC is removed from the list even before development is initiated because of the abundance of nonnative species, making it no longer considered to be jurisdictional or subject to the NFC protection requirements of Miami-Dade County Code (Grossenbacher 2013, pers. comm.).

Summary of Factor D

Currently, *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum, Linum arenicola,* and *Argythamnia blodgettii* are found on Federal, State, and county lands; however, there is no regulatory mechanism in place that provides substantive protection of habitat or protection of potentially suitable habitat at this time. NPS and Service Refuge regulations provide protection at ENP and the Florida Keys Wildlife Refuge Complex, respectively. The Act provides some protection for candidate species on National Wildlife Refuges and during intra-Service section 7 consultations. State regulations provide protection against trade, but allow private landowners or their agents to

clear or remove species on the Florida Regulated Plant Index. State Park regulations provide protection for plants within Florida State Parks. The NFC program in Miami is designed to protect rare and important upland (non-wetlands) habitats in south Florida; however, this regulatory strategy has several limitations (as described above) that reduce its ability to protect the four plants and their habitats.

Although many populations of the four plants are afforded some level of protection because they are on public conservation lands, existing regulatory mechanisms have not led to a reduction or removal of threats posed to these plants by a wide array of sources (see discussions under Factor A, above, and Factor E, below).

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

Other natural or manmade factors affect *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum, Linum arenicola,* and *Argythamnia blodgettii* to varying degrees. Specific threats to these plants included in this factor consist of the spread of nonnative, invasive plants; potentially incompatible management practices (such as mowing and herbicide use); small population size and isolation; effects of pesticide spraying on pollinators; climate change and sea level rise (SLR); and risks from environmental stochasticity (extreme weather) on these small populations. Each of these threats and its specific effect on these plants is discussed in detail below.

Nonnative Plant Species

Nonnative, invasive plants compete with native plants for space, light, water, and nutrients, and make habitat conditions unsuitable for *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum, Linum arenicola,* and *Argythamnia blodgettii,* which prefer open conditions. Bradley and Gann (1999, pp. 13, 71–72) indicated that the control of nonnative plants is one of the most important conservation actions for these plants and a critical part of habitat maintenance.

Nonnative plants have significantly affected pine rocklands, and threaten all occurrences of these four species to some degree (Bradley 2006, pp. 25–26; Bradley and Gann 1999, pp. 18–19; Bradley and Saha 2009, p. 25; Bradley and van der Heiden 2013, pp. 12–16). As a result of human activities, at least 277 taxa of nonnative plants have invaded pine rocklands throughout south Florida (Service 1999, p. 3–175). *Neyraudia neyraudia* (Burma reed) and *Schinus terebinthifolius* (Brazilian pepper) threaten all four species (Bradley and Gann 1999, pp. 13, 72). *S. terebinthifolius,* a nonnative tree, is the most widespread and one of the most invasive species. It forms dense thickets of tangled, woody stems that completely shade out and displace native vegetation (Loflin 1991, p. 19; Langeland and Craddock Burks 1998, p. 54). *Acacia auriculiformis* (earleaf acacia), *Rhynchelytrum repens* (natal grass), *Lantana camara* (shrub verbena), and *Albizia lebbeck* (tongue tree) are some of the other nonnative species in pine rocklands. More species of nonnative plants could become problems in the future, such as *Lygodium microphyllum* (Old World climbing fern), which is a serious threat throughout south Florida. Nonnative plants in pine rocklands can also affect the characteristics of a fire when it does occur. Historically, pine rocklands had an open, low understory where natural fires remained patchy with low temperature intensity, thus sparing many native plants such as *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum, Linum arenicola,* and *Argythamnia blodgettii.* Dense infestations of *Neyraudia neyraudia* and *Schinus terebinthifolius* cause higher fire temperatures and longer burning periods. With the presence of invasive, nonnative species, it is uncertain how fire, even under a managed situation, will affect these plants.

At least 162 nonnative plant species are known to invade rockland hammocks; impacts are particularly severe on the Miami Rock Ridge (Service 1999, pp. 3–135). Nonnative plant species have significantly affected rockland hammocks where *Argythamnia blodgettii* occurs and are considered one of the threats to the species (Snyder *et al.* 1990, p. 273; Hodges and Bradley 2006, p. 14). In many Miami-Dade County parks, nonnative plant species comprise 50 percent of the flora in hammock fragments (Service 1999, pp. 3–135). Horvitz (*et al.* 1998, p. 968) suggests the displacement of native species by nonnative species in conservation and preserve areas is a complex problem with serious impacts to biodiversity conservation, as management in these areas generally does not protect native species and ecological processes, as intended. Problematic nonnative, invasive plants associated with rockland hammocks include *Leucaena leucocephala* (lead tree), *Schinus terebinthifolius, Bischofia javanica* (bishop wood), *Syngonium podophyllum* (American evergreen), *Jasminum fluminense* (Brazilian jasmine), *Rubus niveus* (mysore raspberry), *Nephrolepis brownii* (Asian swordfern), *Schefflera actinophylla* (octopus tree), *Jasminum dichotomum* (Gold Coast jasmine), *Epipremnum pinnatum* (centipede tongavine), and *Nephrolepis cordifolia* (narrow swordfern) (Possley 2013h–i, pers. comm.).

Management of nonnative, invasive plants in pine rocklands and rockland hammocks in Miami-Dade County is further complicated because the vast majority of pine rocklands and rockland hammocks are small, fragmented areas bordered by urban development. In the Florida Keys, larger fragments are interspersed with development. Developed or unmanaged areas that contain nonnative species can act as a seed source for nonnatives, allowing them to continue to invade managed pine rocklands or rockland hammocks (Bradley and Gann 1999, p. 13).

Nonnative plant species are also a concern on private lands, where often these species are not controlled due to associated costs, lack of interest, or lack of knowledge of detrimental impacts to the ecosystem. Undiscovered populations of the four plants on private lands could certainly be at risk. Overall, active management is necessary to control for nonnative species and to protect unique and rare habitats where the four plants occur (Snyder *et al.* 1990, p. 273).

Management of Roadsides and Disturbed Areas

All four plants occur in disturbed areas such as roadsides and areas that formerly were pine rocklands. *Linum arenicola* is particularly vulnerable to management practices in these areas because nearly all populations of the species are currently found on disturbed sites. The large *L. arenicola* population at HARB and SOCSOUTH is located largely in areas that are regularly mowed. Similarly, the small population of *L. arenicola* at the Everglades Archery Range, which is owned by Miami-Dade County and managed as a part of Camp Owaissa Bauer, is growing along the edges of the unimproved perimeter road that is regularly mowed. Finally, the two populations of *L. arenicola* on canal banks are subject to mowing, herbicide treatments, and revegetation efforts (sodding) (Bradley and van der Heiden 2013, pp. 8–10). The population of *Argythamnia blodgettii* at Lignumvitae Key Botanical State Park grows around the perimeter of the large lawn around the residence. Maintenance activities

and encroachment of exotic lawn grasses are potential threats to this population (Hodges and Bradley 2006, p. 14). At Windley Key State Park, *A. blodgettii* grows in two quarry bottoms. In the first, larger quarry, to the east of the visitor center, plants apparently persist only in natural areas not being mowed. However, the majority of the plants are in the farthest quarry, which is not mowed (Hodges and Bradley 2006, p. 15).

While no studies have investigated the effect of mowing on the four plants, research has been conducted on the federally endangered *Linum carteri* var. *carteri* (Carter's small-flowered flax, a close relative of *Linum arenicola* that also occurs in pine rocklands and disturbed sites). The study found significantly higher densities of plants at the mown sites where competition with other plants is decreased (Maschinski and Walters 2007, p. 56). However, plants growing on mown sites were shorter, which may affect fruiting magnitude. While mowing did not usually kill adult plants, if mowing occurred prior to plants reaching reproductive status, it could delay reproduction (Maschinski and Walters 2007, pp. 56–57). If such mowing occurs repeatedly, reproduction of those plants would be entirely eliminated. If, instead, mowing occurs at least 3 weeks after flowering, there would be a higher probability of adults setting fruit prior to mowing; mowing may then act as a positive disturbance by both scattering seeds and reducing competition (Maschinski and Walters 2007, p. 57). The exact impacts of mowing thus depend on the timing of the mowing event, rainfall prior to and following mowing, and the numbers of plants in the population that have reached a reproductive state.

Herbicide applications, the installation of sod, and dumping may affect populations of the four plants that occur on roadsides, canals banks, and other disturbed sites. Signs of herbicide application were noted at the site of the Big Torch Key roadside population of *Linum arenicola* in 2010 (Hodges 2010, p. 2). At the L–31 E canal site, plants of *L. arenicola* were lost on the levee close to Card Sound Road due to the installation of Bahia grass (*Paspalum conjugatum*) sod in recent years, an activity associated with the installation of new culverts. If similar projects are planned, other erosion control measures should be investigated that do not pose a threat to *L. arenicola* (Bradley and Van Der Heiden 2013, p. 10). Illegal dumping of storm-generated trash after Hurricane Wilma had a large impact on roadside populations of plants in the lower Florida Keys (Hodges and Bradley 2006, pp. 11–12, 19, 39).

All populations of the four plants that occur on disturbed sites are vulnerable to regular maintenance activities such as mowing and herbicide applications, and dumping. This includes portions of all populations of *Chamaecrista lineata* var. *keyensis* and *Chamaesyce deltoidea* ssp. *serpyllum,* 10 of 12 *Linum arenicola* populations, and 5 of 34 *Argythamnia blodgettii* populations. All roadside populations are also vulnerable to infrastructure projects such as road widening and installation of underground cable, sewer, and water lines.

Pesticide Effects on Pollinators

Another potential anthropogenic threat to the four plants is current application of insecticides throughout these plants' ranges to control mosquito populations. Currently, an aerial insecticide (1,2-dibromo-2,2-dichloroethyl dimethyl phosphate) and ground insecticide (Permethrin) are applied during the May through November timeframe in many parts of south Florida. Nontarget effects of mosquito control may include the loss of pollinating insects upon which certain plants depend.

Koptur and Liu (2003, p. 1184) reported a decrease in *Chamaecrista lineata* var. *keyensis* pollinator activity following mosquito spraying on Big Pine Key. Mosquito spraying remains a factor on Big Pine Key, and its suppression of pollinator populations may have a long-term impact on reproduction rates. Extensive studies in the Florida Keys suggest that broad spectrum insecticides negatively affect nontarget invertebrates, including pollinators (Hennessey 1991; Eliazar and Emmel 1991; Kevan *et al.* 1997; Salvato 2001; Bargar 2011; Hoang *et al.* 2011). In addition, pesticides have been shown to drift into adjacent undisturbed habitat that serves as a refuge for native biota (Hennessey 1992; Pierce *et al.* 2005; Zhong *et al.* 2010; Bargar 2011). These pesticides can be fatal to nontarget invertebrates that move between urban and forest habitats, altering ecological processes within forest communities (Kevan and Plowright 1989, 1995; Liu and Koptur 2003).

Pesticide spraying practices by the Monroe County Mosquito Control District within NKDR have changed to reduce pesticide use and limit insecticide drift into pine rocklands habitat as a result of agreements between the Service and Florida Keys Mosquito Control District (FKMCD) after critical habitat was designated in 2014 for the Florida leafwing (*Anaea troglodyta floridalis*) and Bartram's scrub-hairstreak (*Strymon acis bartrami*) butterflies (79 FR 47180; August 12, 2014). This designation includes all pine rockland within NKDR where its sole larval host, *Croton linearis,* can potentially occur.

Since 2003, expanded larvicide treatments to surrounding islands have significantly reduced adulticide use on Big Pine Key, No Name Key, and the Torch Keys. In addition, the number of aerially applied Naled treatments allowed on NKDR has been limited since 2008 (Florida Key Mosquito Control District 2012, pp. 10–11). Designated ''No spray zones'' that include the core habitat used by pine rockland butterflies and several linear miles of pine rocklands habitat within the Refuge-neighborhood interface are now excluded from truck spray applications (Anderson 2012, pers. comm.; Service 2012, p. 32). These exclusions and buffer zones encompass over 95 percent of extant croton distribution on Big Pine Key, and include the majority of known recent and historical Florida leafwing population centers on the island (Salvato 2012, pers. comm.). The area largely coincides with the range of these four plants in the lower Florida Keys. Therefore, the effects of mosquito control pesticide application on the pollinators of the four plants have been minimized at NKDR.

In summary, critical habitat regulations for Bartram's scrub-hairstreak butterfly and Florida leafwing have extended benefits to populations of these four plants and their pollinator guild by limiting mosquito insecticide activity in pine rocklands habitat in the Florida Keys. Nevertheless, we are proceeding cautiously and have initiated a multi-year research project to further investigate the level of impact pesticides have on these four plants and their pollinators throughout their ranges.

Environmental Stochasticity

Endemic species whose populations exhibit a high degree of isolation and narrow geographic distribution, such as *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum, Linum arenicola,* and *Argythamnia blodgettii,* are extremely susceptible to extinction from both random and nonrandom catastrophic natural or human-caused events. Of the four species, *Argythamnia blodgettii* is probably less vulnerable because of the larger number of sites where it occurs throughout Miami-Dade and Monroe Counties. Small populations of species,

without positive growth rates, are considered to have a high extinction risk from site-specific demographic and environmental stochasticity (Lande 1993, pp. 911–927).

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

Florida is considered the most vulnerable State in the United States to hurricanes and tropical storms (Florida Climate Center, *http://coaps.fsu.edu/climate_center*). Based on data gathered from 1856 to 2008, Klotzbach and Gray (2009, p. 28) calculated the climatological probabilities for each State being impacted by a hurricane or major hurricane in all years over the 152-year timespan. Of the coastal States analyzed, Florida had the highest climatological probabilities, with a 51 percent probability of a hurricane (Category 1 or 2) and a 21 percent probability of a major hurricane (Category 3 or higher). From 1856 to 2008, Florida experienced 109 hurricanes, 36 of which were considered major hurricanes. Given the few isolated populations and restricted range of the four plants in locations prone to storm influences (*i.e.,* Miami-Dade and Monroe Counties), they are at substantial risk from hurricanes, storm surges, and other extreme weather events.

Hurricanes, storm surge, and extreme high tide events are natural events that can pose a threat to the four plants. Hurricanes and tropical storms can modify habitat (*e.g.,* through storm surge) and have the potential to destroy entire populations. Climate change may lead to increased frequency and duration of severe storms (Golladay *et al.* 2004, p. 504; McLaughlin *et al.* 2002, p. 6074; Cook *et al.* 2004, p. 1015). The four plants experienced these disturbances historically, but had the benefit of more abundant and contiguous habitat to buffer them from extirpations. With most of the historical habitat having been destroyed or modified, the few remaining populations of these plants could face local extirpations due to stochastic events.

The Florida Keys were impacted by three hurricanes in 2005: Katrina on August 26, Rita on September 20, and Wilma on October 24. Hurricane Wilma had the largest impact, with storm surges flooding much of the landmass of the Keys. In some places, this water impounded and sat for days. The vegetation in many areas was top-killed due to salt water inundation (Hodges and Bradley 2006, p. 9). Flooding kills plants that do not have adaptations to tolerate anoxic soil conditions that persist after flooding; the flooding and resulting high salinities might also impact soil seed banks of the four plants (Bradley and Saha 2009, pp. 27–28). After hurricane Wilma, the herb layer in pine rocklands in close proximity to the coast was brown with few plants having live material above ground (Bradley 2006, p. 11). Subsequent surveys found no *Linum arenicola* and little *Chamaecrista lineata* var. *keyensis* or *Chamaesyce deltoidea* ssp. *serpyllum* in areas where they previously occurred. Not only did the storm surge kill the vegetation, but many of the roadside areas were heavily disturbed by dumping and removal of storm debris (Bradley 2006, p. 37). Estimates of the population sizes pre- and post-Wilma were calculated for *Chamaesyce deltoidea* ssp. *serpyllum* and *Chamaecrista lineata* var. *keyensis.* Each declined in the months following the storm, by 41.2 percent and 48.0 percent, respectively (Bradley and Saha 2009, p. 2). *L. arenicola* was not found at all in surveys 8 to 9 weeks after the hurricane (Bradley 2006, p. 36). The Middle Torch Key population was extirpated after Hurricane Wilma, and the population on Big Torch Key declined drastically, with only one individual located. Both of these areas were heavily affected by storm surges during Hurricane Wilma (Hodges 2010, p. 2). As of 2013, populations of *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum,* and *L. arenicola* in the Florida Keys have not returned to pre-Hurricane Wilma levels (Bradley *et al.* 2015, pp. 21, 25, 29).

Some climate change models predict increased frequency and duration of severe storms, including hurricanes and tropical storms (McLaughlin *et al.* 2002, p. 6074; Cook *et al.* 2004, p. 1015; Golladay *et al.* 2004, p. 504). Other models predict hurricane and tropical storm frequencies in the Atlantic are expected to decrease between 10 and 30 percent by 2100 (Knutson *et al.* 2008, pp. 1–21). For those models that predict fewer hurricanes, predictions of hurricane wind speeds are expected to increase by 5 to 10 percent due to an increase in available energy for intense storms. Increases in hurricane winds can elevate the chances of damage to existing canopy and increase storm surge heights.

All populations of the four plants are vulnerable to hurricane wind damage. Populations close to the coast and all populations of the four plants in the Florida Keys are vulnerable to inundation by storm surge. Historically, the four plant species may have benefitted from more abundant and contiguous habitat to buffer them from storm events. The small size of many populations of these plants makes them especially vulnerable, in which the loss of even a few individuals could reduce the viability of a single population. The destruction and modification of native habitat, combined with small population size, has likely contributed over time to the stress, decline, and, in some instances, extirpation of populations or local occurrences due to stochastic events.

Due to the small size of some existing populations of *Chamaecrista lineata* var. *keyensis, Linum arenicola,* and *Argythamnia blodgettii* (see below) and the narrow geographic range of all four plant species, their overall resilience to these factors is likely low. These factors, combined with additional stress from habitat loss and modification (*e.g.,* inadequate fire management) may increase the inherent risk of stochastic events that impact these plants. For these reasons, all four plants are at risk of extirpation during extreme stochastic events. Of the four species, *Argythamnia blodgettii* is probably less vulnerable because of the larger number of sites where it occurs throughout Miami-Dade and Monroe Counties.

Small Population Size and Isolation

Endemic species whose populations exhibit a high degree of isolation are extremely susceptible to extinction from both random and nonrandom catastrophic natural or human-caused events. Species that are restricted to geographically limited areas are inherently more vulnerable to extinction than widespread species because of the increased risk of genetic bottlenecks, random demographic fluctuations, climate change, and localized catastrophes such as hurricanes and disease outbreaks (Mangel and Tier 1994, p. 607; Pimm *et al.* 1998, p. 757). These problems are further magnified when populations are few and restricted to a very small geographic area, and when the number of individuals is very small. Populations with these

characteristics face an increased likelihood of stochastic extinction due to changes in demography, the environment, genetics, or other factors (Gilpin and Soule 1986, pp. 24–34). Small, isolated populations often exhibit reduced levels of genetic variability, which diminishes the species' capacity to adapt and respond to environmental changes, thereby decreasing the probability of long-term persistence (*e.g.,* Barrett and Kohn 1991, p. 4; Newman and Pilson 1997, p. 361). Very small plant populations may experience reduced reproductive vigor due to ineffective pollination or inbreeding depression. Isolated individuals have difficulty achieving natural pollen exchange, which limits the production of viable seed. The problems associated with small population size and vulnerability to random demographic fluctuations or natural catastrophes are further magnified by synergistic interactions with other threats, such as those discussed above (see Factors A and C).

Chamaecrista lineata var. *keyensis* and *Chamaesyce deltoidea* ssp. *serpyllum* both have large populations on Big Pine Key. The other extant occurrence of *Chamaecrista lineata* var. *keyensis* in the Florida Keys, on Cudjoe Key, is small. Five out of 12 extant *Linum arenicola* populations, and 20 of 34 *Argythamnia blodgettii* populations, have fewer than 100 individuals. These small populations are at risk of adverse effects from reduced genetic variation, an increased risk of inbreeding depression, and reduced reproductive output. Many of these populations are small and isolated from each other, decreasing the likelihood that they could be naturally reestablished in the event that extinction from one location would occur. *Argythamnia blodgettii* is the only one of the four plants species that occurs in ENP, where a population of over 2,000 plants is stable and prescribed fire and other management activities that benefit *A. blodgettii* are conducted on a regular basis.

Climate Change and Sea Level Rise

Climatic changes, including sea level rise (SLR), are occurring in the State of Florida and are impacting associated plants, animals, and habitats. Our analyses under the Act include consideration of ongoing and projected changes in climate. The term ''climate,'' as defined by the Intergovernmental Panel on Climate Change (IPCC), refers to the mean and variability of different types of weather conditions over time, with 30 years being a typical period for such measurements, although shorter or longer periods also may be used (IPCC 2013, p. 1450). The term ''climate change'' thus refers to a change in the mean or variability of one or more measures of climate (*e.g.,* temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC 2013, p. 1450). A recent compilation of climate change and its effects is available from IPCC reports (IPCC 2013, entire).

Scientific measurements spanning several decades demonstrate that changes in climate are occurring, and that the rate of change has been faster since the 1950s. Examples include warming of the global climate system, and substantial increases in precipitation in some regions of the world and decreases in other regions. (For these and other examples, see IPCC 2007a, p. 30; Solomon *et al.* 2007, pp. 35–54, 82–85). Results of scientific analyses presented by the IPCC show that most of the observed increase in global average temperature since the mid-20th century cannot be explained by natural variability in climate, and is ''very likely'' (defined by the IPCC as 90 percent or higher probability) due to the observed increase in greenhouse gas (GHG) concentrations in the atmosphere as a result of human activities, particularly carbon dioxide emissions from use of fossil fuels (IPCC 2007a, pp. 5–6 and figures SPM.3 and SPM.4; Solomon *et al.* 2007, pp. 21–35). Further confirmation of the role of GHGs comes from analyses by Huber and Knutti (2011, p. 4), who concluded it is extremely likely that approximately 75 percent of global warming since 1950 has been caused by human activities.

Scientists use a variety of climate models, which include consideration of natural processes and variability, as well as various scenarios of potential levels and timing of GHG emissions, to evaluate the causes of changes already observed and to project future changes in temperature and other climate conditions (*e.g.,* Meehl *et al.* 2007, entire; Ganguly *et al.* 2009, pp. 11555, 15558; Prinn *et al.* 2011, pp. 527, 529). All combinations of models and emissions scenarios yield very similar projections of increases in the most common measure of climate change, average global surface temperature (commonly known as global warming), until about 2030. Although projections of the magnitude and rate of warming differ after about 2030, the overall trajectory of all the projections is one of increased global warming through the end of this century, even for the projections based on scenarios that assume that GHG emissions will stabilize or decline. Thus, there is strong scientific support for projections that warming will continue through the 21st century, and that the magnitude and rate of change will be influenced substantially by the extent of GHG emissions (IPCC 2007a, pp. 44–45; Meehl *et al.* 2007, pp. 760–764, 797–811; Ganguly *et al.* 2009, pp. 15555–15558; Prinn *et al.* 2011, pp. 527, 529). (See IPCC 2007b, p. 8, for a summary of other global projections of climate-related changes, such as frequency of heat waves and changes in precipitation. Also see IPCC 2011 (entire) for a summary of observations and projections of extreme climate events.)

Various changes in climate may have direct or indirect effects on species. These effects may be positive, neutral, or negative, and they may change over time, depending on the species and other relevant considerations, such as interactions of climate with other variables (*e.g.,* habitat fragmentation) (IPCC 2007, pp. 8–14, 18–19). Identifying likely effects often involves aspects of climate change vulnerability analysis. Vulnerability refers to the degree to which a species (or system) is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the type, magnitude, and rate of climate change and variation to which a species is exposed, its sensitivity, and its adaptive capacity (IPCC 2007a, p. 89; see also Glick *et al.* 2011, pp. 19–22). There is no single method for conducting such analyses that applies to all situations (Glick *et al.* 2011, p. 3). We use our expert judgment and appropriate analytical approaches to weigh relevant information, including uncertainty, in our consideration of various aspects of climate change.

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

Global climate projections are informative, and, in some cases, the only or the best scientific information available for us to use. However, projected changes in climate and related

impacts can vary substantially across and within different regions of the world (*e.g.,* IPCC 2007a, pp. 8–12). Therefore, we use ''downscaled'' projections when they are available and have been developed through appropriate scientific procedures, because such projections provide higher resolution information that is more relevant to spatial scales used for analyses of a given species (see Glick *et al.* 2011, pp. 58–61, for a discussion of downscaling).

With regard to our analysis for *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum, Linum arenicola,* and *Argythamnia blodgettii,* downscaled projections suggest that SLR is the largest climate-driven challenge to low-lying coastal areas in the subtropical ecoregion of southern Florida (U.S. Climate Change Science Program (USCCSP) 2008, pp. 5–31, 5–32). All populations of the four plants occur at elevations from 2.83–4.14 meters (m) (9.29–13.57 feet (ft)) above sea level, making these plants highly susceptible to increased storm surges and related impacts associated with SLR.

We acknowledge that the drivers of SLR (especially contributions of melting glaciers) are not completely understood, and there is uncertainty with regard to the rate and amount of SLR. This uncertainty increases as projections are made further into the future. For this reason, we examine threats to the species within the range of projections found in recent climate change literature.

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

Subsequent to the 2007 IPCC Report, the scientific community has continued to model SLR. Recent peer-reviewed publications indicate a movement toward increased acceleration of SLR. Observed SLR rates are already trending along the higher end of the 2007 IPCC estimates, and it is now widely held that SLR will exceed the levels projected by the IPCC (Rahmstorf *et al.* 2012, p. 1; Grinsted *et al.* 2010, p. 470). Taken together, these studies support the use of higher end estimates now prevalent in the scientific literature. Recent studies have estimated global mean SLR of 1.0–2.0 m (3.3–6.6 ft) by 2100 as follows: 0.75–1.90 m (2.50–6.20 ft; Vermeer and Rahmstorf 2009, p. 21530); 0.8–2.0 m (2.6–6.6 ft; Pfeffer *et al.* 2008, p. 1342); 0.9–1.3 m (3.0–4.3 ft; Grinsted *et al.* 2010, pp. 469–470); 0.6–1.6 m (2.0–5.2 ft; Jevrejeva *et al.* 2010, p. 4); and 0.5–1.4 m (1.6–4.6 ft; National Research Council 2012, p. 2).

Other processes expected to be affected by projected warming include temperatures, rainfall (amount, seasonal timing, and distribution), and storms (frequency and intensity) (see ''Environmental Stochasticity'', above). Models where sea surface temperatures are increasing also show a higher probability of more intense storms (Maschinski *et al.* 2011, p. 148). The Massachusetts Institute of Technology (MIT) modeled several scenarios combining various levels of SLR, temperature change, and precipitation differences with human population growth, policy assumptions, and conservation funding changes. All of the scenarios, from small climate change shifts to major changes, indicate significant effects on coastal Miami-Dade County. The Science and Technology Committee of the Miami-Dade County Climate Change Task Force (Wanless *et al.* 2008, p. 1) recognize that significant SLR is a serious concern for Miami-Dade County in the near future. In a January 2008 statement, the committee warned that sea level is expected to rise at least 0.9–1.5 m (3.0–5.0 ft) within this century (Wanless *et al.* 2008, p. 3). With a 0.9–1.2 m (3.0–4.0 ft) rise in sea level (above baseline) in Miami-Dade County, spring high tides would be at about 1.83–2.13 m (6.0–7.0 ft); freshwater resources would be gone; the Everglades would be inundated on the west side of Miami-Dade County; the barrier islands would be largely inundated; storm surges would be devastating to coastal habitat and associated species; and landfill sites would be exposed to erosion, contaminating marine and coastal environments. Freshwater and coastal mangrove wetlands will be unable to keep up with or offset SLR of 0.61 m (2.0 ft) per century or greater. With a 1.52 m (5.0 ft) rise, Miami-Dade County will be extremely diminished (Wanless *et al.* 2008, pp. 3–4).

SLR projections from various scenarios have been downscaled by TNC (2011, entire) and Zhang *et al.* (2011, entire) for the Florida Keys. Using the IPCC best-case, low-pollution scenario, a rise of 18 cm (7 in) (a rate close to the historical average reported above) would result in the inundation of 23,796 ha (58,800 acres) or 38.2 percent of the Florida Keys upland area by the year 2100 (TNC 2011, p. 25). Under the IPCC worst-case, high-pollution scenario, a rise of 59 cm (23.2 in) would result in the inundation of 46,539 ha (115,000 acres) or 74.7 percent of the Florida Keys upland area by the year 2100 (TNC 2011, p. 25). Using Rahmstorf *et al.'s* (2007; p. 368) SLR projections of 100 to 140 cm, 80.5 to 92.2 percent of the Florida Keys land area would be inundated by 2100. The Zhang *et al. (*2011, p. 136) study models SLR up to 1.8 m (5.9 ft) for the Florida Keys, which would inundate 93.6 percent of the current land area of the Keys.

Prior to inundations from SLR, there will likely be habitat transitions related to climate change, including changes to hydrology and increasing vulnerability to storm surge. Hydrology has a strong influence on plant distribution in coastal areas (IPCC 2008, p. 57). Such communities typically grade from salt to brackish to freshwater species. From the 1930s to 1950s, increased salinity contributed to the decline of cabbage palm forests in southwest Florida (Williams *et al.* 1999, pp. 2056–2059), expansion of mangroves into adjacent marshes in the Everglades (Ross *et al.* 2000, pp. 101, 111), and loss of pine rocklands in the Keys (Ross *et al.* 1994, pp. 144, 151–155). In Florida, pine rocklands transition into rockland hammocks, and, as such, these habitat types are closely associated in the landscape. A study conducted in one pine rocklands location on Sugar Loaf Key (with an average elevation of 0.89 m (2.90 ft)) found an approximately 65 percent reduction in an area occupied by South Florida slash pine over a 70-year period, with pine mortality and subsequent increased proportions of halophytic (salt-loving) plants occurring earlier at the lower elevations (Ross *et al.* 1994, pp. 149–152). During this same time span, local sea level had risen by 15 cm (6 in), and Ross *et al.* (1994, p. 152) found evidence of groundwater and soil water salinization. Extrapolating this situation to hardwood hammocks is

not straightforward, but it suggests that changes in rockland hammock species composition may not be an issue in the immediate future (5–10 years); however, over the long term (within the next 10–50 years), it may be an issue if current projections of SLR occur and freshwater inputs are not sufficient to maintain high humidities and prevent changes in existing canopy species through salinization (Saha *et al.* 2011, pp. 22–25). Ross *et al.* (2009, pp. 471–478) suggested that interactions between SLR and pulse disturbances (*e.g.,* storm surges) can cause vegetation to change sooner than projected based on sea level alone.

Impacts from climate change including regional SLR have been studied for coastal hammocks but not rockland hammock habitat. Saha (*et al.* 2011, pp. 24–25) conducted a risk assessment on rare plant species in ENP and found that impacts from SLR have significant effects on imperiled taxa. This study also predicted a decline in the extent of coastal hammocks with initial SLR, coupled with a reduction in freshwater recharge volume and an increase in pore water (water filling spaces between grains of sediment) salinity, which will push hardwood species to the edge of their drought (freshwater shortage and physiological) tolerance, jeopardizing critically imperiled or endemic species, or both, with possible extirpation. In south Florida, SLR of 1–2 m (3.3–6.6 ft) is estimated by 2100, which is on the higher end of global estimates for SLR. These projected increases in sea level pose a threat to coastal plant communities and habitats from mangroves at sea level to salinity-intolerant, coastal rockland hammocks where elevations are generally less than 2.0 m (6.1 ft) above sea level (Saha *et al.* 2011, p. 2). Loss or degradation of these habitats can be a direct result of SLR or in combination of several other factors, including diversion of freshwater flow, hurricanes, and exotic plant species infestations, which can ultimately pose a threat to rare plant populations (Saha *et al.* 2011, p. 24).

Habitats for these species are restricted to relatively immobile geologic features separated by large expanses of flooded, inhospitable wetland or ocean, leading us to conclude that these habitats will likely not be able to migrate as sea level rises (Saha *et al.* 2011, pp. 103–104). Because of the extreme fragmentation of remaining habitat and isolation of remaining populations, and the accelerating rate at which SLR is projected to occur (Grinsted *et al.* 2010, p. 470), it will be particularly difficult for these species to disperse to suitable habitat once existing sites that support them are lost to SLR. Patterns of development will also likely be significant factors influencing whether natural communities can move and persist (IPCC 2008, p. 57; CCSP 2008, pp. 7–6). The plant species face significant risks from coastal squeeze that occurs when habitat is pressed between rising sea levels and coastal development that prevents landward migration of species. The ultimate effect of these impacts is likely to result in reductions in reproduction and survival, with corresponding decreases in population numbers.

Saha (*et al.* 2011, p. 4) suggested that the rising water table accompanying SLR will shrink the vadose zone (the area which extends from the top of the ground surface to the water table); increase salinity in the bottom portion of the freshwater lens, thereby increasing brackishness of plant-available water; and influence tree species composition of coastal hardwood hammocks based upon species-level tolerance to salinity or drought or both. Evidence of population declines and shifts in rare plant communities, along with multi-trophic effects, already have been documented on the low-elevation islands of the Florida Keys (Maschinski *et al.* 2011, p. 148).

Direct losses to extant populations of all four plants are expected due to habitat loss and modification from SLR by 2100. We analyzed existing sites that support populations of the four plants using the National Oceanic and Atmospheric Administration (NOAA) Sea Level Rise and Coastal Impacts viewer. Below, we discuss general implications of sea level rise within the range of projections discussed above on the current distribution of these species. The NOAA tool uses 1-foot increments, so the analysis is based on 0.91 m (3 ft) and 1.8 m (6 ft).

Chamaecrista lineata var. *keyensis:* A 0.91-m (3-ft) rise would inundate most areas of Big Pine Key, and all areas of Cudjoe Key, that support *Chamaecrista lineata* var. *keyensis,* and reduce both Keys to several much smaller islands. The remaining uplands on these islands would likely transition to buttonwoods and saltmarshes, and would be extremely vulnerable to storm surge. This will further reduce and fragment these populations. A 1.8-m (6-ft) rise would completely inundate all areas that support *C. lineata* var. *keyensis* and eliminate all pine rocklands habitat within the historic range of the species.

Chamaesyce deltoidea var. *serpyllum:* A 0.91-m (3-ft) rise would inundate most areas of Big Pine Key that support *Chamaesyce deltoidea* var. *serpyllum,* and reduce the Key to three to five much smaller islands. The remaining uplands would likely transition to buttonwoods and saltmarshes, and would be extremely vulnerable to storm surge. This will further reduce and fragment the population. A 1.8-m (6-ft) rise would completely inundate all areas that support *C. deltoidea* var. *serpyllum* and eliminate all pine rocklands habitat within the historic range of the species.

Linum arenicola: In Miami-Dade County, a 0.91-m (3-ft) rise would inundate the area that supports a large extant population of *Linum arenicola* along L–31E canal. While other areas that support the species are located in higher elevation areas along the coastal ridge, changes in the salinity of the water table and soils, along with additional vegetation shifts in the region, are likely. Remaining uplands may transition to wetter, more salt-tolerant plant communities. This will further reduce and fragment the populations. A 1.8-m (6-ft) rise would inundate portions of the largest known population (HARB), as well the population along L–31E canal. The areas that support *Linum arenicola* at the Richmond pinelands to the north would not be inundated, but pine rocklands in these areas may be reduced through transition to wetter, more salt-tolerant plant communities, as discussed above.

In the Florida Keys, a 0.91-m (3-ft) rise would inundate most areas of Big Pine Key and Lower Sugarloaf Key, and all of the areas on Upper Sugarloaf Key and Big Torch Key, that support *Linum arenicola,* and reduce these Keys to numerous much smaller islands. The remaining uplands on these small islands would likely transition to buttonwoods and saltmarshes, and would be extremely vulnerable to further losses due to storm surge. This would further reduce and fragment the populations. A 1.8-m (6-ft) rise would completely inundate all areas that support *Linum arenicola* in the Florida Keys and eliminate all pine rocklands habitat within the historic range of the species in Monroe County.

Argythamnia blodgettii: In Miami-Dade County, a 0.91-m (3-ft) rise would not inundate any extant populations of *Argythamnia blodgettii* because these habitats are located in higher elevation areas along the coastal ridge. However, changes in the salinity of the water table and soils, along with additional vegetation shifts in the region, are likely. Remaining uplands may likely transition to wetter, more salt-tolerant plant communities. This will further

reduce and fragment the populations. A 1.8-m (6-ft) rise would inundate portions of Crandon Park, making it unsuitable for *A. blodgettii.* Other areas that support *A. blodgettii,* including the Richmond pinelands to the north, and Long Pine Key in ENP, would not be inundated, but habitats in these areas may be reduced through transition to wetter, more salt-tolerant plant communities, as discussed above.

In the Florida Keys, a 0.91-m (3-ft) rise would reduce the area of islands in the upper Keys, but extant populations on Key Largo, Windley Key, and Lignumvitae Key are less vulnerable than the Middle and Lower Keys, which are at lower elevations. Lower Matecumbe Key, Plantation Key, Vaca Key, Big Pine Key, and Big Munson Island would be fragmented and reduced to numerous much smaller islands. The remaining uplands on these small islands would likely transition to buttonwoods and saltmarshes, and would be extremely vulnerable further losses to storm surge. This would further reduce and fragment the populations. A 1.8–m (6–ft) rise would completely inundate all areas that support *Argythamnia blodgettii* south of Lignumvitae Key. Key Largo, Windley Key, and Lignumvitae Key are the only existing areas supporting extant populations that could continue to support a population given a 1.8-m (6-ft) sea level rise.

Conservation Efforts To Reduce Other Natural or Manmade Factors Affecting Its Continued Existence

NPS, the Service, Miami-Dade County, and the State of Florida have ongoing nonnative plant management programs to reduce threats on public lands, as funding and resources allow. In Miami-Dade County, nonnative, invasive plant management is very active, with a goal to treat all publicly owned properties at least once a year and more often in many cases. IRC and FTBG conduct research and monitoring in various natural areas within Miami-Dade County and the Florida Keys for various endangered plant species and nonnative, invasive species.

Summary of Factor E

We have analyzed threats from other natural or manmade factors including: Nonnative, invasive plants; management practices used on roadsides and disturbed sites (such as mowing, sodding, and herbicide use); pesticide spraying and its effects on pollinators; environmental stochasticity; effects from small population size and isolation; and the effects of climate change, including SLR. The related risks from hurricanes and storm surge act together to impact populations of all four plants. Some of these threats (*e.g.,* nonnative species) may be reduced on public lands due to active programs by Federal, State, and county land managers. Many of the remaining populations of these plants are small and geographically isolated, and genetic variability is likely low, increasing the inherent risk due to overall low resilience of these plants.

Cumulative Effects of Threats

When two or more threats affect populations of the four plants, the effects of those threats could interact or become compounded, producing a cumulative adverse effect that is greater than the impact of either threat alone. The most obvious cases in which cumulative adverse effects would be significant are those in which small populations (Factor E) are affected by threats that result in destruction or modification of habitat (Factor A). The limited distributions and small population sizes of many populations of the four plants make them extremely susceptible to the detrimental effects of further habitat modification, degradation, and loss, as well as other anthropogenic threats. Mechanisms leading to the decline of the four plants, as discussed above, range from local (*e.g.,* agriculture) to regional (*e.g.,* development, fragmentation, nonnative species) to global (*e.g.,* climate change, SLR) influences. The synergistic effects of threats, such as impacts from hurricanes on a species with a limited distribution and small populations, make it difficult to predict population viability. While these stressors may act in isolation, it is more probable that many stressors are acting simultaneously (or in combination) on populations of these four plants, making them more vulnerable.

Determination

We have carefully assessed the best scientific and commercial data available regarding the past, present, and future threats to *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum, Linum arenicola,* and *Argythamnia blodgettii.* Numerous populations of all four plants have been extirpated from these species' historical ranges, and the primary threats of habitat destruction and modification resulting from human population growth and development, agricultural conversion, and inadequate fire management (Factor A); competition from nonnative, invasive species (Factor E); changes in climatic conditions, including SLR (Factor E); and natural stochastic events (Factor E) remain threats for existing populations. Existing regulatory mechanisms have not led to a reduction or removal of threats posed to the four plants from these factors (see Factor D discussion, above). These threats are ongoing, rangewide, and expected to continue in the future. A significant percentage of populations of *Chamaecrista lineata* var. *keyensis, Linum arenicola,* and *Argythamnia blodgettii* are relatively small and isolated from one another, and their ability to recolonize suitable habitat is unlikely without human intervention, if at all. The threats have had and will continue to have substantial adverse effects on the four plants and their habitats. Although attempts are ongoing to alleviate or minimize some of these threats at certain locations, all populations appear to be impacted by one or more threats.

The Act defines an endangered species as ''any species which is in danger of extinction throughout all or a significant portion of its range'' and a threatened species as ''any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.'' As described in detail above, *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum,* and *Linum arenicola* are currently at risk throughout all of their range due to the immediacy, severity, significance, timing, and scope of those threats. Impacts from these threats are ongoing and increasing; singly or in combination, these threats place these three plants in danger of extinction. The risk of extinction is high because the populations are small, are isolated, and have limited to no potential for recolonization. Numerous threats are currently ongoing and are likely to continue in the foreseeable future, at a high intensity and across the entire range of these plants. Furthermore, natural stochastic events and changes in climatic conditions pose a threat to the persistence of these plants, especially in light of the fact these events cannot be controlled and mitigation measures have yet to be addressed. Individually and collectively, all these threats can contribute to the local extirpation and potential extinction of these plant species. Because these threats are placing them in danger of extinction throughout their ranges, we have determined that each of these three plants meets the definition of an endangered species throughout their ranges.

Throughout its range, *Argythamnia blodgettii* faces threats similar to the

other three plant species that are the subjects of this rule. However, we find that endangered species status is not appropriate for *A. blodgettii.* While we have evidence of threats under Factors A, D, and E affecting the species, insufficient data are available to identify the trends in extant populations. Twenty populations are extant, 15 are extirpated, and we are uncertain of the status of 15 populations that have not been surveyed in 15 years or more. Additionally, data show that the threat of habitat loss from sea level rise is not as severe for this species. Also, *A. blodgettii* is likely less vulnerable because of the larger number of sites where it occurs throughout Miami-Dade and Monroe Counties. Further, *A. blodgettii* is the only one of the four plants species that occurs in ENP, where a population of over 2,000 plants is stable and where prescribed fire and other management activities that benefit *A. blodgettii* are conducted on a regular basis. Therefore, based on the best available information,

Significant Portion of the Range (SPR)

Under the Act and our implementing regulations, a species may warrant listing if it is endangered or threatened throughout all or a significant portion of its range. The threats to the survival of *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum, Linum arenicola,* and *Argythamnia blodgettii* occur throughout these species' ranges and are not restricted to any particular significant portion of those ranges. Accordingly, our assessment and determination applies to each of the four plants throughout its entire range. Because we have determined that *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum,* and *Linum arenicola* meet the definition of endangered species, and *Argythamnia blodgettii* meets the definition of a threatened species, throughout their ranges, no portion of their ranges can be ''significant'' for purposes of the definitions of ''endangered species'' and ''threatened species.'' See the Service's SPR Policy (79 FR 37578; July 1, 2014).

Therefore, on the basis of the best available scientific and commercial information, we list *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum,* and *Linum arenicola* as endangered species in accordance with sections 3(6) and 4(a)(1) of the Act. We find that threatened species status is not appropriate for *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum,* and *Linum arenicola* because of the contracted range of each species and because the threats are occurring rangewide, are ongoing, and are expected to continue into the future. We find that *A. blodgettii* is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range, and we list the species as a threatened species in accordance with sections 3(20) and 4(a)(1) of the Act.

Available Conservation Measures

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

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

Recovery planning includes the development of a recovery outline shortly after a species is listed and preparation of a draft and final recovery plan. The recovery outline guides the immediate implementation of urgent recovery actions and describes the process to be used to develop a recovery plan. Revisions of the plan may be done to address continuing or new threats to the species, as new substantive information becomes available. The recovery plan also identifies recovery criteria for review of when a species may be ready for downlisting or delisting, and methods for monitoring recovery progress. Recovery plans also establish a framework for agencies to coordinate their recovery efforts and provide estimates of the cost of implementing recovery tasks. Recovery teams (composed of species experts, Federal and State agencies, nongovernmental organizations, and stakeholders) are often established to develop recovery plans. If these four plant species are listed, a recovery outline, draft recovery plan, and the final recovery plan will be available on our Web site (*http://www.fws.gov/endangered*), or from our South Florida Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**).

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

Please let us know if you are interested in participating in recovery efforts for *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum, Linum arenicola,* and *Argythamnia blodgettii.* Additionally, we invite you to submit any new information on these plants whenever it becomes available and any information you may have for recovery planning purposes (see **FOR FURTHER INFORMATION CONTACT**).

Section 7(a) of the Act requires Federal agencies to evaluate their actions with respect to any species that is listed as an endangered or threatened species and with respect to its critical habitat, if any is designated. Regulations implementing this interagency cooperation provision of the Act are codified at 50 CFR part 402. Section

7(a)(2) of the Act requires Federal agencies to ensure that activities they authorize, fund, or carry out are not likely to jeopardize the continued existence of the species or destroy or adversely modify its critical habitat. If a Federal action may affect a listed species or its critical habitat, if designated, the responsible Federal agency must enter into consultation with the Service.

Federal agency actions within the species' habitat that may require consultation as described in the preceding paragraph include management and any other landscape-altering activities on Federal lands administered by the Service, NPS, and Department of Defense; issuance of section 404 Clean Water Act (33 U.S.C. 1251 *et seq.*) permits by the U.S. Army Corps of Engineers; construction and management of gas pipeline and power line rights-of-way by the Federal Energy Regulatory Commission; construction and maintenance of roads or highways by the Federal Highway Administration; and disaster relief efforts conducted by the Federal Emergency Management Agency.

With respect to endangered plants, prohibitions outlined at 50 CFR 17.61 make it illegal for any person subject to the jurisdiction of the United States to import or export, transport in interstate or foreign commerce in the course of a commercial activity, sell or offer for sale in interstate or foreign commerce, or to remove and reduce to possession any such plant species from areas under Federal jurisdiction. In addition, for endangered plants, the Act prohibits malicious damage or destruction of any such species on any area under Federal jurisdiction, and the removal, cutting, digging up, or damaging or destroying of any such species on any other area in knowing violation of any State law or regulation, or in the course of any violation of a State criminal trespass law. Exceptions to these prohibitions are outlined at 50 CFR 17.62. With respect to threatened plants, 50 CFR 17.71 provides that, with certain exceptions, all of the prohibitions outlined at 50 CFR 17.61 for endangered plants also apply to threatened plants. Permit exceptions to the prohibitions for threatened plants are outlined at 50 CFR 17.72.

Preservation of native flora of Florida through Florida Statutes 581.185, sections (3)(a) and (3)(b), provide limited protection to species listed in the State of Florida Regulated Plant Index including *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum, Linum arenicola,* and *Argythamnia blodgettii,* as described under the Factor D discussion, above. Federal listing will increase protection for these plants by making violations of section 3 of the Florida Statute punishable as a Federal offense under section 9 of the Act. This would provide increased protection from unauthorized collecting and vandalism for the plants on State and private lands, where they might not otherwise be protected by the Act, and would increase the severity of the penalty for unauthorized collection, vandalism, or trade in these plants.

The Service acknowledges that it cannot fully address some of the natural threats facing *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum, Linum arenicola,* and *Argythamnia blodgettii,* (*e.g.,* hurricanes, storm surge) or even some of the other significant, long-term threats (*e.g.,* climatic changes, SLR). However, through listing, we can provide protection to the known populations and any new population of these plants that may be discovered (see discussion below). With listing, we can also influence Federal actions that may potentially impact these plants (see discussion below); this is especially valuable if these plants are found at additional locations. With listing, we will also be better able to deter illicit collection and trade.

We may issue permits to carry out otherwise prohibited activities involving endangered or threatened plants under certain circumstances. Regulations governing permits for endangered plants are codified at 50 CFR 17.62, and for threatened plants at 50 CFR 17.72. With regard to endangered plants, the Service may issue a permit authorizing any activity otherwise prohibited by 50 CFR 17.61 for scientific purposes or for enhancing the propagation or survival of endangered plants.

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

(1) Import any such species into, or export any of the four plant species from, the United States.

(2) Remove and reduce to possession any of the four plant species from areas under Federal jurisdiction; maliciously damage or destroy any of the four plant species on any such area; or remove, cut, dig up, or damage or destroy any of the four plant species on any other area in knowing violation of any law or regulation of any State or in the course of any violation of a State criminal trespass law.

(3) Deliver, receive, carry, transport, or ship in interstate or foreign commerce, by any means whatsoever and in the course of a commercial activity, any of the four plant species.

(4) Sell or offer for sale in interstate or foreign commerce any of the four plant species.

(5) Introduce any nonnative wildlife or plant species to the State of Florida that compete with or prey upon *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum, Linum arenicola,* or *Argythamnia blodgettii.*

(6) Release any unauthorized biological control agents that attack any life stage of *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum, Linum arenicola,* or *Argythamnia blodgettii.*

(7) Manipulate or modify, without authorization, the habitat of *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum, Linum arenicola,* or *Argythamnia blodgettii* on Federal lands.

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

When *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum, Linum arenicola,* and *Argythamnia blodgettii* are listed under the Act, the State of Florida's Endangered Species Act (Florida Statutes 581.185) is automatically invoked, which also prohibits take of these plants and encourages conservation by State government agencies. Further, the State may enter into agreements with Federal agencies to administer and manage any area required for the conservation, management, enhancement, or protection of endangered species (Florida Statutes 581.185). Funds for these activities can be made available

under section 6 of the Act (Cooperation with the States). Thus, the Federal protection afforded to these plants by listing them as endangered species will be reinforced and supplemented by protection under State law.

Activities that the Service believes could potentially harm these four plants include, but are not limited to:

(1) Actions that would significantly alter the hydrology or substrate, such as ditching or filling. Such activities may include, but are not limited to, road construction or maintenance, and residential, commercial, or recreational development.

(2) Actions that would significantly alter vegetation structure or composition, such as clearing vegetation for construction of residences, facilities, trails, and roads.

(3) Actions that would introduce nonnative species that would significantly alter vegetation structure or composition. Such activities may include, but are not limited to, residential and commercial development, and road construction.

(4) Application of herbicides, or release of contaminants, in areas where these plants occur. Such activities may include, but are not limited to, natural resource management, management of rights-of-way, residential and commercial development, and road construction.

Critical Habitat

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

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

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

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

In our proposed listing rule, we determined that because the designation of critical habitat will not likely increase the degree of threat to the species and may provide some measure of benefit, the designation of critical habitat is prudent for *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum, Linum arenicola,* and *Argythamnia blodgettii.*

Our regulations (50 CFR 424.12(a)(2)) further state that critical habitat is not determinable when one or both of the following situations exists: (1) Information sufficient to perform required analysis of the impacts of the designation is lacking; or (2) the biological needs of the species are not sufficiently well known to permit identification of an area as critical habitat. On the basis of a review of available information, we find that critical habitat for *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum, Linum arenicola,* and *Argythamnia blodgettii* is not determinable because the specific mapping and economic information sufficient to perform the required analysis of the impacts of the designation is currently lacking. We are still in the process of obtaining more information needed to properly evaluate the economic impacts of designation. We intend to publish a proposed rule designating critical habitat for *Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum, Linum arenicola,* and *Argythamnia blodgettii* by the end of fiscal year 2017.

Required Determinations

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

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

References Cited

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

Authors

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

List of Subjects in 50 CFR Part 17

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

Regulation Promulgation

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

PART 17—ENDANGERED AND THREATENED WILDLIFE AND PLANTS

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

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

■ 2. Amend § 17.12(h) by adding entries for *Argythamnia blodgettii, Chamaecrista lineata* var. *keyensis, Chamaesyce deltoidea* ssp. *serpyllum,* and *Linum arenicola,* in alphabetical order under FLOWERING PLANTS, to the List of Endangered and Threatened Plants to read as follows:

§ 17.12 Endangered and threatened plants.

* * * * *

(h) * * *

Scientific name	Common name	Where listed	Status	Listing citations and applicable rules
FLOWERING PLANTS				
* *	*	* *		* *
Argythamnia blodgettii	Blodgett's silverbush	Wherever found	T	[Insert **Federal Register** citation]; September 29, 2016.
* *	*	* *		* *
Chamaecrista lineata var. *keyensis*.	Big Pine partridge pea	Wherever found	E	[Insert **Federal Register** citation]; September 29, 2016.
* *	*	* *		* *
Chamaesyce deltoidea ssp. *serpyllum*.	Wedge spurge	Wherever found	E	[Insert **Federal Register** citation]; September 29, 2016.
* *	*	* *		* *
Linum arenicola	Sand flax	Wherever found	E	[Insert **Federal Register** citation]; September 29, 2016.
* *	*	* *		* *

Dated: September 21, 2016.

Stephen Guertin,

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

[FR Doc. 2016–23546 Filed 9–28–16; 8:45 am]

BILLING CODE 4333–15–P

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR Part 648

[Docket No. 151130999–6225–01]

RIN 0648–XE895

Fisheries of the Northeastern United States; Atlantic Bluefish Fishery; Quota Transfer

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Temporary rule; approval of quota transfer.

SUMMARY: NMFS announces its approval of a transfer of a portion of the 2016 commercial bluefish quota from the State of North Carolina to the Commonwealth of Massachusetts. This approval of the transfer complies with the Atlantic Bluefish Fishery Management Plan quota transfer provision. This announcement also informs the public of the revised commercial quotas for North Carolina and Massachusetts.

DATES: Effective September 28, 2016, through December 31, 2016.

FOR FURTHER INFORMATION CONTACT: Reid Lichwell, Fishery Management Specialist, (978) 281–9112.

SUPPLEMENTARY INFORMATION: Regulations governing the Atlantic bluefish fishery are found in 50 CFR 648.160 through 648.167. The regulations require annual specification of a commercial quota that is apportioned among the coastal states from Maine through Florida. The process to set the annual commercial quota and the percent allocated to each state are described in § 648.162.

The final rule implementing Amendment 1 to the Bluefish Fishery Management Plan published in the **Federal Register** on July 26, 2000 (65 FR 45844), and provided a mechanism for transferring bluefish quota from one state to another. Two or more states, under mutual agreement and with the concurrence of the Administrator, Greater Atlantic Region, NMFS (Regional Administrator), can request approval of a transfer of bluefish commercial quota under § 648.162(e)(1)(i) through (iii). The Regional Administrator must first approve any such transfer based on the criteria in § 648.162(e).

North Carolina and Massachusetts have requested the transfer of 75,000 lb (34,019 kg) of bluefish commercial quota from North Carolina to Massachusetts. Both states have certified that the transfer meets all pertinent state requirements. This quota transfer was requested by Massachusetts to ensure that its 2016 quota would not be exceeded. The Regional Administrator has approved this quota transfer based on his determination that the criteria set forth in § 648.162(e)(1)(i) through (iii) have been met. The revised bluefish quotas for calendar year 2016 are: North Carolina, 1,391,100 lb (630,992 kg); and Massachusetts, 553,096 lb (250,880 kg). These quota adjustments revise the quotas specified in the final rule implementing the 2016–2018 Atlantic Bluefish Specifications published on August 4, 2016 (81 FR 51370), and reflect all subsequent commercial bluefish quota transfers completed to date. For information of previous transfers for fishing year 2016 visit: *http://go.usa.gov/xZT8H.*

Classification

This action is taken under 50 CFR part 648 and is exempt from review under Executive Order 12866.

Authority: 16 U.S.C. 1801 *et seq.*

Emily H. Menashes,

Acting Director, Office of Sustainable Fisheries, National Marine Fisheries Service.

[FR Doc. 2016–23469 Filed 9–28–16; 8:45 am]

BILLING CODE 3510–22–P