

Pigeon wings
(Clitoria fragrans)

5-Year Review:
Summary and Evaluation

U.S. Fish and Wildlife Service
Southeast Region
South Florida Ecological Services Office
Vero Beach, Florida

I. GENERAL INFORMATION

A. Methodology used to complete the review: This review is based on monitoring reports, surveys, and other scientific and management information, augmented by conversations and comments from biologists familiar with the species. The review was conducted by an Archbold Biological Station (ABS) plant ecologist and finalized by biologists with the South Florida Ecological Services Office. Literature and documents used for this review are on file at the South Florida Ecological Services Office. All recommendations resulting from this review are a result of thoroughly reviewing the best available information on pigeon wings. Public notice of this review was given in the Federal Register on April 26, 2007, with a 60-day public comment period. Comments and suggestions regarding the review were received from peer reviews outside the Service (refer to Summary of Peer review). Comments received were evaluated and addressed as appropriate.

B. Reviewers

Lead Region: Southeast Region, Kelly Bibb, (404) 679-7132

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C. Background

1. FR Notice citation announcing initiation of this review: April 26, 2007. 72 FR 20866.

2. Species status: Stable (2007 Recovery Data Call). The long-term species status was reported as stable because 33.5 of 35 known populations are protected and relatively stable. Most protected lands where populations occur are managed for conservation of scrub habitats and their associated species.

3. Recovery achieved: 1 (0-25% recovery objectives completed) (2007 Recovery Data Call).

4. Listing history

Original Listing

FR notice: 58 FR 25746

Date listed: April 27, 1993

Entity listed: Species

Classification: Threatened

5. Associated rulemakings: N/A

6. Review History:

Final Recovery Plan: 1999

Recovery Data Call: 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007

7. Species' Recovery Priority Number at start of review (48 FR 43098): 14. A recovery priority number of "14" represents a low degree of threat and high recovery potential.

8. Recovery Plan or Outline

Name of plan: South Florida Multi-Species Recovery Plan (MSRP)

Date issued: May 18, 1999

Dates of previous revisions: June 20, 1996. Recovery Plan for nineteen central Florida scrub and high pineland plants (revised).

II. REVIEW ANALYSIS

A. Application of the 1996 Distinct Population Segment (DPS) policy

1. Is the species under review listed as a DPS? No. The Endangered Species Act (Act) defines species as including any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate wildlife. This definition limits listing DPS to only vertebrate species of fish and wildlife. Because the species under review is a plant and the DPS policy is not applicable, the application of the DPS policy to the species listing is not addressed further in this review.

B. Recovery Criteria

1. Does the species have a final, approved recovery plan containing objective, measurable criteria? Yes. However, the criteria included in the 1999 recovery plan require modification and expansion to include more updated habitat information for criterion 3 and to include threat based criteria for factors C, D, and E.

2. Adequacy of recovery criteria.

a. Do the recovery criteria reflect the best available and most up-to-date information on the biology of the species and its habitat? No. See explanation above and under criterion 3.

b. Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria (and is there no new information to consider regarding existing or new threats)? No. Factors C, D, and E are not included in the recovery criteria.

3. List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information. For threats-related recovery criteria, please note which of the 5 listing factors are addressed by that

criterion. If any of the 5 listing factors are not relevant to this species, please note that here.

Factor B is not relevant to this species.

Criteria for delisting pigeon wings:

1. Enough demographic data are available to determine the appropriate numbers of self-sustaining populations and sites needed to ensure 95% probability of persistence for 100 years.

This criterion has not been met. Satisfying this criterion would require collection of detailed demographic data (*sensu* Menges and Gordon 1996), such as monitoring of large samples of marked individuals in multiple populations over several years. These studies provide quantitative assessments of survivorship, growth, and fecundity. Data are also needed on the reproductive biology, seed ecology, and perhaps genetic diversity of the species. To provide adequate guidelines for managing pigeon wings, population viability analysis (PVA) models will require data drawn from populations with differing fire histories, because the ideal fire regime for regeneration of pigeon wings has not been identified. At present, detailed demographic data are not being collected from any populations. The largest available demographic datasets (Stout and Lewis 2006; C. Weekley, ABS, pers. comm. 2008) are based on fewer than 150 plants at each of two sites.

Element occurrence records (EORs) are compiled by the Florida Natural Areas Inventory (FNAI). Each EOR represents a species occurrence that is a minimum of 1 kilometer (km) from another occurrence of the same species, thus a large site may have multiple EORs associated with it. The (FNAI) database lists 77 element occurrence records (EORs) for pigeon wings. Fifty-four EORs are on protected sites and 24 EORs are outside protected areas. Most of the records for the unprotected sites are more than 20 years old and their current status is unknown.

2. When these sites, within the historic range of *C. fragrans*, are adequately protected from habitat loss, degradation, and fragmentation.

This criterion has been partially met through the acquisition of populations on sites protected by federal, state, county, and private conservation agencies and organizations. Protected populations occur in Lake, Polk and Highlands Counties on the Lake Wales Ridge (LWR) and Winter Haven Ridge and on the Avon Park Air Force Range (APAFR) on the Bombing Range Ridge and contiguous uplands. These populations span most of the known historic range of the species. Fifteen of the sixteen managed areas listed by Turner et al. (2006) occur on the LWR, ranging from the Warea Tract of Seminole State Forest (aka Flat Lake) in the north to ABS in the south. Three of the areas targeted for acquisition in Turner et al. (2006) have since been acquired, as has Lake Blue, the single managed area on the Winter Haven Ridge. In addition, a previously undocumented population occurs at Lake Griffin State Park on the Sumter

Upland in Lake County (J. Stout, University of Central Florida, pers. comm. 2008c). Historic pigeon wings populations from Orange and Osceola Counties (Fantz 1977, Wunderlin et al. 1980) have apparently been extirpated.

This criterion addresses factors A and E.

3. When these sites are managed to maintain the ecotone between xeric oak scrub and high pine that supports *C. fragrans*.

This criterion has not been met. This criterion reflects an antiquated understanding of pigeon wings' habitat requirements. As more recent studies have shown, pigeon wings occurs in several xeric upland habitats on white, yellow, and gray sands (Menges et al. 2007b, Stout and Lewis 2006). However, the spirit of the criterion retains its validity in that it requires the appropriate use of fire to manage and maintain pigeon wings' habitat. The occurrence of pigeon wings in both frequent and infrequent fire return interval habitats (i.e., both sandhill and scrub) suggests that it is tolerant of a range of fire return intervals. However, determining the optimal fire return interval (Menges 2007) for pigeon wings populations requires data that are not currently available. This criterion addresses factor A.

4. When monitoring programs demonstrate that populations of *C. fragrans* on these sites support the appropriate numbers of self-sustaining populations, and those populations are stable throughout the historic range of the species.

This criterion has not been met. Although there have been recent surveys of pigeon wings populations at APAFR (Stout and Lewis 2006), Lake Wales Ridge State Forest (LWRSF) (Clanton 2007; A. Malatesta, Florida Division of Forestry, pers. comm. 2008), Tiger Creek Preserve (B. Pace-Aldana, The Nature Conservancy, pers. comm. 2008), and at several smaller protected sites in Highlands and Polk Counties (Weekley et al. 2001; Menges et al. 2007a; C. Weekley, pers. comm. 2008), none provide data on changes in population sizes in well-defined areas over time. However, periodic re-surveys of marked individuals at APAFR or of well-defined populations at other sites where level 1 surveys (*sensu* Menges and Gordon 1996) are currently taking place could provide data on population trends in the future.

ABS's Population Dynamics of Endemic Plants (PDEP) project is currently surveying sites managed by the Florida Fish and Wildlife Conservation Commission (e.g., Carter Creek North, Lake Blue, Silver Lake) and the Service (e.g., Carter Creek South, Flamingo Villas) to map new locations and to collect abundance data for federally listed and selected state-listed plants. As of May 2008, surveys have included five sites, 14 species, 402 species occurrences, and 4,541 counted individuals. PDEP surveys recorded 92 pigeon wings plants at three sites. Mapped populations will be revisited at appropriate intervals and/or following significant management activities to assess changes in population sizes. At Silver Lake, for example, post-treatment surveys are currently quantifying changes in abundance of pigeon wings within 47, 5-m radius plots that were initially surveyed pre-treatment. Treatments included mechanical

removal of woody vegetation (chainsaw felling of subcanopy, gyro-tracking of shrubs) and prescribed fire.

C. Updated Information and Current Species Status

1. Biology and Habitat

a. Abundance, population trends (e.g., increasing, decreasing, stable), demographic features (e.g., age structure, sex ratio, family size, birth rate, age at mortality, mortality rate), or demographic trends: Since the MSRP (Service 1999), little additional data have been collected on pigeon wings. Level 2 surveys (*sensu* Menges and Gordon 1996), which require counts or estimates of populations sizes, have been conducted at a number of sites (e.g., Weekley et al. 2001; Stout and Lewis 2006; Menges et al. 2007a; Clanton 2007; A. Malatesta, pers. comm. 2008; B. Pace-Aldana, pers. comm. 2008). Stout and Lewis (2006) and Lewis (2007) collected survival, density, and fecundity data on 142 plants at APAFR from 2003 to 2005. Most surveys confirm the persistence of populations previously recorded, but do not provide data on population trends.

Abundance estimates – EORs compiled by FNAI do not provide abundance estimates. However, abundance data based on recent counts or estimates are available for three of the largest protected sites. Jack Stout (pers. comm. 2008b) reported 2,951 plants for APAFR based on complete surveys of 59 soil polygons conducted between 2002 and 2006. Plants were individually tagged and mapped with a GPS (Stout pers. comm. 2008c). Malatesta (pers. comm. 2008) reports >1,800 plants from LWRSF (including the Arbuckle, Walk-in-Water, and Hesperides tracts); however, the surveys were conducted over a period of three years and some populations may have been counted twice, thereby inflating the final estimate. Pace-Aldana (pers. comm. 2008) estimates the pigeon wings population at Tiger Creek Preserve at >1,000 plants. These numbers, collected over large areas, generally provide estimates of the lower limits of population sizes at each of these three sites.

Minimum abundance estimates are also available for several of the smaller sites, including Crooked Lake Sandhill (n = 49; B. Pace-Aldana, pers. comm. 2008), the Warea Tract of Seminole State Forest (n = 43; Cox 2006), and the Carter Creek North (n = 15), Silver Lake (n = 58), and Lake Blue (n = 19) tracts of the Lake Wales Ridge Wildlife and Environmental Area (LWRWEA) (Menges et al. 2007a; C. Weekley, pers. comm. 2008).

Population trends - In a study of the postfire responses of 12 Florida scrub endemics, Weekley and Menges (2003) characterized pigeon wings as a moderate resprouter based on the percentage of tagged aboveground individuals present two years postburn (48.4%). However, aboveground pigeon wings populations may fluctuate annually due to belowground

dormancy (C. Weekley, pers. comm. 2008). Anecdotal evidence also indicates that dramatic increases in postburn aboveground population sizes may be short-lived (C. Weekley, pers. obs. 2008). Thus, population densities may increase postfire and decline with time-since-fire. High percent flowering by postburn plants also suggests that they are more likely resprouts than seedling recruits (C. Weekley, pers. obs. 2008).

Data on population trends are scarce for pigeon wings because monitoring programs at most sites do not involve repeated censuses of populations within well defined areas. However, the evidence that is available, usually based on short-term surveys of relatively few individuals, suggests substantial year to year fluctuations in aboveground population sizes. For example, annual monitoring of a small pigeon wings population (< 70 plants in all years surveyed) at ABS from 1992 to 2000 found annual survival rates ranging from 72 to 98% (C. Weekley, pers. comm. 2008). Stout et al. (2003) recorded an annual survival rate of 68% (28 of 43 plants) in one APAFR population tagged in 2002 and re-surveyed one year later.

Demographic features - There are only two small datasets (< 150 records) that contain useful information on the demographic characteristics of pigeon wings populations. At ABS, annual monitoring of a small long-unburned population from 1992 to 2000 found that 62% (28 of 45) of vegetative individuals tagged in the first year of the project were still alive nine years later (C. Weekley, pers. comm. 2008). These data provide the only estimate available for the lifespan of pigeon wings individuals and support its classification as a long-lived (> 5 years) perennial. Over the nine years of the study, sexual reproduction was negligible and few seedlings were found (C. Weekley, pers. comm. 2008). The study also documented the presence of belowground dormancy in pigeon wings, with 14% of tagged plants re-appearing aboveground following a year or more in which they were absent.

Stout and Lewis (2006) and Lewis (2007) followed 142 plants in seven belt transects at APAFR from 2003-2005. Lewis (2007) reported “modest” increases in plant densities on recently burned transects, but her sample sizes were too small to detect statistical significance, and factors other than fire may explain the observed differences among transects.

Additional demographic data from the APAFR belt transects were collected between 2002 and 2007 and a report on the 5-year project is currently being prepared (Stout, pers. comm. 2008c).

The data on population growth rates in Lewis (2007) are inconclusive and highly variable. Lewis (2007) found that plants produce more cleistogamous (CL) than chasmogamous (CH) flowers, but overall flower and fruit production were low. CL flowers do not open, and therefore do not allow cross pollination between individuals, thus all resulting seeds are selfed. CH

flowers, in contrast, do open, which allows outcrossing to occur. Over the two years of her study, Lewis (2007) recorded only two fruits from CH flowers on her 83 study plants and ~20% fruit set from CL flowers. These low rates of sexual reproduction are consistent with observations from Menges (C. Weekley, pers. comm. 2008) in the ABS study. However, other observers of postfire populations have generally noted more CH than CL flowers (A. Faivre, Cedar Crest College, pers comm. 2008). Stout suggests that the spike in postburn CH flowering noted by other observers is short-lived and that CL flowering predominates in subsequent weeks (Stout, pers. comm. 2008c). However, very little data are available on postfire flowering phenology. Lewis (2007) was unable to evaluate the effect of time-since-fire or season-of-fire on fecundity.

b. Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding): There have been no genetic studies of pigeon wings.

c. Taxonomic classification or changes in nomenclature: None. The Integrated Taxonomic Information System (2008) was checked while conducting this review.

d. Spatial distribution, trends in spatial distribution (e.g., increasingly fragmented, increased numbers of corridors), or historic range (e.g., corrections to the historical range, change in distribution of the species' within its historic range): Fantz (1977) and Wunderlin et al. (1980) listed records from Lake, Osceola, Orange, Polk, and Highlands Counties. Populations in Osceola and Orange Counties have apparently been lost. No recent comparable contractions in the geographic range are known. However, within the current geographic range, additional loss of unprotected populations may result in the isolation of protected populations, especially on smaller sites. Additional surveys and analyses will be necessary to determine how habitat loss and fragmentation within pigeon wings' current range is affecting protected populations.

Christman (1988) recorded the presence of pigeon wings in 21.8% (42 of 193) of the scrub sites he surveyed in the late 1980s. Christman's records have been incorporated into the Florida Natural Areas Inventory (FNAI) database. FNAI lists 77 EORs for pigeon wings. Fifty-four (70.1%) EORs are on protected sites on the Lake Wales (45) or Winter Haven Ridges (1), or on the APAFR (8). Of the 24 EORs outside protected areas, all but two are on the LWR (one each on the Winter Haven and Mount Dora Ridges); most of these records are more than 20 years old and their current status is unknown. About a third of the EORs for protected areas (19 of 54) are based on surveys by Schultz et al. (1999) of Conservation and Recreation Lands (CARL) sites in Lake, Polk and Highlands Counties, and by Weekley et al. (2001) of nine protected sites in Highlands County.

Schultz et al. (1999) recorded 18 EORs for pigeon wings from 12 CARL sites, 11 of which are on the LWR. All but three of these sites have been acquired since 1999, including Lake Blue on the Winter Haven Ridge.

Weekley et al. (2001) surveyed eight managed areas in Highlands County to map the occurrences of 20 federally listed plants. For priority one species, including pigeon wings, Weekley et al. (2001) estimated population sizes within a 10-meter radius of the center of each patch of the targeted species using log10 categories. This survey resulted in 13 occurrences of pigeon wings on five managed areas; most occurrence records included 1-9 plants.

Pigeon wings was among 36 imperiled LWR species evaluated by Turner et al. (2006) using protection indices for each species and for three time periods (past, current, targeted) based on number of locations, extent of occurrence, and area of occupancy. The overall protection index of < 2 for pigeon wings marks it as of high conservation concern. However, three of the targeted areas in Turner et al. (2006) have since been acquired.

A previously undocumented population occurs at Lake Griffin State Park in Lake County, about 24 km northwest of the LWR (Stout, pers. comm. 2008c).

Pigeon wings is currently known from 18 managed areas on the LWR: A. D. Broussard Catfish Creek Preserve State Park, ABS, Crooked Lake Sandhill, Jack Creek, LWRSF (Arbuckle, Hesperides, and Walk-in-Water Tracts), Lake Wales Ridge National Wildlife Refuge (Carter Creek South, Flamingo Villas), LWRWEA (Carter Creek North, Holmes Avenue, Lake Placid Scrub, Mountain Lake Cutoff, Royce Ranch, Silver Lake, and Sunray/Hickory Lake Tracts), Seminole State Forest (Warea Tract), and Tiger Creek Preserve. It is also protected at Lake Griffin State Park on the Sumter Upland, LWRWEA (Lake Blue) on the Winter Haven Ridge, and at APAFR.

e. Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem): Pigeon wings is a soil generalist, occurring on a yellow, white, and gray sands (Menges et al. 2007b; S. Orzell, APAFR, pers. comm. 2008; J. Stout, pers. comm. 2008a). It occurs in a range of xeric upland habitats on the Lake Wales, Winter Haven, and Bombing Range Ridges and on xeric upland sites west of Bombing Range Ridge within APAFR. On the southern third of the LWR (i.e., the part within Highlands County), it occurs primarily on yellow sands (e.g., Astatula, Paola, and Tavares) in sandhill and oak-hickory scrub, but also on moderately well-drained white sands (Archbold), and on gray sands (Satellite) (Menges et al. 2007b). On the LWR in Polk and Lake Counties, it is also known from yellow, white, and gray sands. On APAFR, it is recorded from four gray sand types (Daytona, Narcoossee, Zolfo, and Duette), primarily in sandhill and oak scrub (J. Stout, pers. comm. 2008a; S. Orzell, pers. comm. 2008). Orzell

recently reported a small population at APAFR on Satellite soil (Stout, pers. comm. 2008c).

f. Other: Heavy vertebrate and invertebrate predation, including the destruction of entire seed crops or the complete removal of aboveground individuals, have been documented for pigeon wings (e.g., Stout and Lewis 2004; Lewis 2007; A. Faivre, pers. comm. 2008). *Clitoria* spp. are host species for the hoary edge (*Achalarus lyciades*) and long-tailed (*Urbanus proteus*) skippers and the southern cloudywing (*Thorybes bathyllus*) butterfly (Minno et al. 2005). Long-tailed skippers and southern cloudywings are both known to use pigeon wings as host plants (Stout and Lewis 2004; C. Weekley, pers. obs. 2008). The impact on pigeon wings plants of partial or complete defoliation is unknown. Other likely invertebrate predators on pigeon wings include orthopterans and possibly seed predating coleopterans. Vertebrate herbivores probably include white-tailed deer (*Odocoileus virginianus*) and eastern cottontail rabbits (*Sylvilagus floridanus*). Herbivory may threaten the persistence of local populations. Pigeon wings plants overgrown by *Cuscuta* sp., a parasitic plant, at one study site at APAFR failed to flower (Stout, pers. comm. 2008c), suggesting that competition for light or resources may limit flowering.

2. Five-Factor Analysis

a. Present or threatened destruction, modification or curtailment of its habitat or range: Pigeon wings is protected in 18 managed areas on LWR and in three managed areas off LWR. However, almost one-third (24 of 77) of the FNAI EORs are on unprotected sites. It is not known how many of these sites remain. Although unprotected populations at Avon Park Lakes were targeted for acquisition (Turner et al. 2006), the site is quickly being converted to residential development and the population will almost certainly be lost. Surveys of other unprotected FNAI EORs will be required to determine if they are still extant.

b. Overutilization for commercial, recreational, scientific, or educational purposes: None known.

c. Disease or predation: Observers following individually marked pigeon wings plants have often noted heavy herbivory on leaves, flowers, and fruits by insects and complete predation of whole plants by vertebrates (Lewis 2007; A. Faivre, pers. comm. 2008; Stout and Lewis 2004; C. Weekley, pers. obs. 2008). Leaf herbivory is most likely due to long-tailed skipper and southern cloudywing butterfly caterpillars. Flower herbivory may be due to orthopterans, and fruit and seed predation are likely due to coleopterans. Consumption of entire plants is most likely due to white-tailed deer and rabbits. It is well known that both invertebrate and vertebrate herbivory of plants can severely impact the fecundity and reproductive output at both the

individual (Amsberry and Maron 2006) and population level (Maron and Crone 2006). However, the population level impact of predation specifically on pigeon wings has not been determined.

There is no evidence of disease affecting pigeon wings.

d. Inadequacy of existing regulatory mechanisms: Pigeon wings is listed as endangered by the State of Florida on the Regulated Plant Index (Florida Department of Agriculture and Consumer Services Rule 5B-40). This law regulates the taking, transport, and sale of listed plants. However, property owners are not prohibited under this law from destroying populations of listed plants nor are they required to manage habitats to maintain populations.

Existing federal and state regulations prohibit the removal or destruction of listed plant species on public lands. However, they afford no protection to listed plants on private lands. In addition, state regulations are less stringent than federal regulations on land management practices that may adversely affect populations of listed plants. Existing regulatory mechanisms are inadequate to protect this species.

e. Other natural or manmade factors affecting its continued existence: Human development has disrupted the natural disturbance regime for pigeon wings. Because pigeon wings occurs in fire dependent communities with a range of natural fire return intervals, we can infer that it can tolerate a range of fire frequencies and intensities. Some data (Weekley and Menges 2003, Lewis 2007) and anecdotal evidence (C. Weekley, pers. obs. 2008) suggest that aboveground populations decline as the time-since-fire interval increases. Thus, inadequacies in existing prescribed fire programs or the use of mechanical methods such as mowing or gyro-tracking as a substitute or pre-treatment for fire may be adversely affecting the persistence of populations. Observations by B. Blihovde at Lake Wales Ridge NWR suggest pigeon wings thrive in and around mechanically treated fire breaks. Data being generated by ABS's PDEP project aims to provide answers to some of these questions. In the meantime, development of science-based guidelines for the management of pigeon wings is precluded for lack of data.

D. Synthesis – Pigeon wings has a final recovery plan, but the recovery criteria need to be revised to provide updated objectives for habitat (see criterion 3) and threats based criteria to address factors C, D, and E.

Protected areas now encompass most of the known range of pigeon wings (Turner et al. 2006), as well as over two-thirds of documented occurrences (FNAI EORs). However, many unprotected sites still exist. Additional surveys are needed to assess the status of these unprotected sites. Moreover, even populations in protected areas may be threatened due to the inadequate use of prescribed fire or use of mechanical substitutes for fire which may adversely affect populations.

Sufficient data presently does not exist by which to measure the population dynamics of protected populations or to gauge the adequacy of existing management regimes. Although recent mapping efforts using GPS/GIS have resulted in estimates of population sizes at some of the most important sites, repeated data collection over multiple years is needed for meaningful assessments of population trends. Multi-year data from sites pre- and post-fire in experimental treatments are needed to provide a science-based recommendation of the optimal fire regime for pigeon wings. Likewise, similar data are needed for responses to mechanical treatments to determine their suitability as substitutes for fire. Research currently being carried out by ABS scientists will help address this lack of data and provide improved recommendations for the management of habitats where pigeon wings occur.

Due to the probability of continued populations losses at unprotected sites and the lack of adequate fire management at existing protected sites, pigeon wings continues to meet the definition of threatened under the Act.

III. RESULTS

A. Recommended Classification:

 X No change is needed

IV. RECOMMENDATIONS FOR FUTURE ACTIONS

- Conduct surveys to assess the status of the 24 FNAI EORs that occur on unprotected sites and to evaluate the feasibility of protecting additional pigeon wings populations. Any new populations discovered should be added to the FNAI database.
- Following Turner et al. (2006), extant parcels at Avon Park Lakes (Highlands County) and Trout Lake (Polk County) should be targeted for acquisition. Acquisition of these sites might also extend protection to other federally listed plants (e.g., *Crotalaria avonensis* at Avon Park Lakes).
- As we learn more about the fire requirements of pigeon wings, prescriptions should be adjusted to a frequency and intensity appropriate to the regeneration of the species to avoid habitat degradation.
- Quantitative surveys (e.g., Weekley et al. 2001; Stout and Lewis 2006; A. Malatesta, pers. comm. 2008) of pigeon wings populations at several sites establish the basis for level 2 monitoring (*sensu* Menges and Gordon 1996) to track changes in population size over time and in response to management treatments. These surveys should be repeated at defined intervals (e.g., annually, bi-annually, every five years; both before and after imposition of management treatments) and take place within well-defined areas (e.g., within plots small enough to be searched thoroughly and thereby reduce inconsistencies in sampling intensity). ABS's PDEP was designed as a model of level 2 monitoring that can be deployed by other agencies.
- Demographic data need to be collected across the full geographic range of pigeon wings, from both scrub and high pine habitats, and from populations responding to contrasting management treatments (e.g., fire alone vs. various mechanical treatments

- being used as a substitute or pre-treatment to fire).
- The extent of invertebrate and vertebrate predation on pigeon wings needs to be quantified.
 - Genetic studies should be conducted to understand the genetic diversity of the species; this may aid in the identification of new acquisition needs.
 - Where monitoring is being conducted, data should be collected on fire management activities to aid in the interpretation of trends and identifying the most favorable treatments.

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of Pigeon wings (*Clitoria fragrans*)

Current Classification Threatened
Recommendation resulting from the 5-Year Review

- Downlist to Threatened
- Uplist to Endangered
- Delist
- No change is needed

Appropriate Listing/Reclassification Priority Number, if applicable _____

Review Conducted By Carl W. Weekley, Archbold Biological Station

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approve [Signature] Date 7-8-08

The lead Field Office must ensure that other offices within the range of the species have been provided adequate opportunity to review and comment prior to the review's completion. The lead field office should document this coordination in the agency record.

REGIONAL OFFICE APPROVAL:

The Regional Director or the Assistant Regional Director, if authority has been delegated to the Assistant Regional Director, must sign all 5-year reviews.

for Lead Regional Director, Fish and Wildlife Service

Approve [Signature] Date 9/15/08

The Lead Region must ensure that other regions within the range of the species have been provided adequate opportunity to review and comment prior to the review's completion. If a change in classification is recommended, written concurrence from other regions is required.

Cooperating Regional Director, Fish and Wildlife Service

Concur Do Not Concur

Signature _____ Date _____

Summary of peer review for the 5-year review of Pigeon Wings (*Clitoria fragrans*)

A. Peer Review Method: The Service solicited review and comment from four peer reviewers. Individual responses were received from three of the peer reviewers.

B. Peer Review Charge: See attached guidance.

C. Summary of Peer Review Comments/Report: Peer review comments were minor. They included two recommendations for future actions, editorial issues, clarifications on data summarized from personal communications, and a small amount of new ecological data. There were two suggestions for future actions: (1) to conduct surveys of genetic diversity to aid in the identification of additional acquisition needs and (2) to include data on fire management in routine monitoring to help clarify population trends in response to management activities. Both recommendations reflected the comments of other reviewers on the need for genetic and demographic data.

One reviewer suggested that the review could be improved by including a section on known management activities. Another reviewer indicated personal knowledge of a small population of pigeon wings at Lake Griffin State Park and Recreation Area and provided some additional data on a 5-year monitoring project at Avon Park Air Force Range. A third reviewer argued that the use of the term “stable” in section C.2. (Species status) was inappropriate.

D. Response to Peer Review: In general, the Service agreed with all comments and concerns received from peer reviewers. Specifically, the two recommendations for future actions were incorporated, several minor editorial issues were addressed, information on data collected at one site was added, and the characterization of the reproductive biology of pigeon wings to include a personal observation was amended. It was not possible to add a special section on known management activities because no agency is currently managing specifically for pigeon wings. The section on the distribution of pigeon wings has been amended to include the previously undocumented population at Lake Griffin State Park. The species status of pigeon wings was reported as “stable” based on the 2007 Recovery Data Call; this determination will be re-evaluated during the 2008 Recovery Data Call.

Guidance for Peer Reviewers of Five-Year Status Reviews
U.S. Fish and Wildlife Service, South Florida Ecological Services Office

February 20, 2007

As a peer reviewer, you are asked to adhere to the following guidance to ensure your review complies with U.S. Fish and Wildlife Service (Service) policy.

Peer reviewers should:

1. Review all materials provided by the Service.
2. Identify, review, and provide other relevant data apparently not used by the Service.
3. Not provide recommendations on the Endangered Species Act classification (e.g., endangered, threatened) of the species.
4. Provide written comments on:
 - Validity of any models, data, or analyses used or relied on in the review.
 - Adequacy of the data (e.g., are the data sufficient to support the biological conclusions reached). If data are inadequate, identify additional data or studies that are needed to adequately justify biological conclusions.
 - Oversights, omissions, and inconsistencies.
 - Reasonableness of judgments made from the scientific evidence.
 - Scientific uncertainties by ensuring that they are clearly identified and characterized, and that potential implications of uncertainties for the technical conclusions drawn are clear.
 - Strengths and limitation of the overall product.
5. Keep in mind the requirement that the Service must use the best available scientific data in determining the species' status. This does not mean the Service must have statistically significant data on population trends or data from all known populations.

All peer reviews and comments will be public documents and portions may be incorporated verbatim into the Service's final decision document with appropriate credit given to the author of the review.

Questions regarding this guidance, the peer review process, or other aspects of the Service's recovery planning process should be referred to Cindy Schulz, Endangered Species Supervisor, South Florida Ecological Services Office, at 772-562-3909, extension 305, email: Cindy_Schulz@fws.gov.