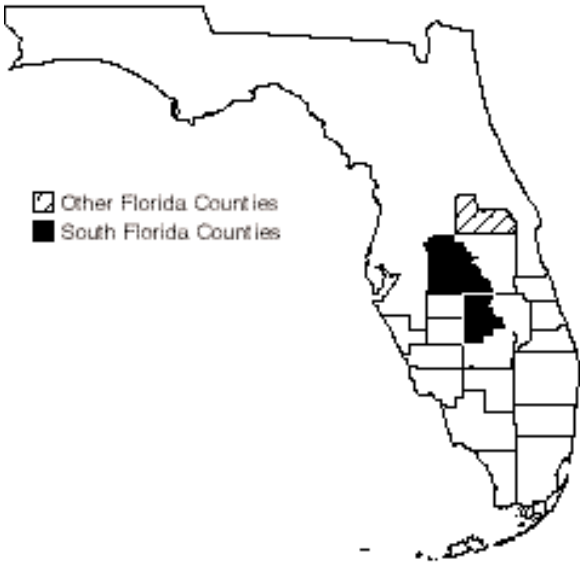
Pigeon Wings

Clitoria fragrans Small

Federal Status:	**Threatened (April 27, 1993)**
Critical Habitat:	**None Designated**
Florida Status:	**Endangered**
Recovery Plan Status:	**Revision (May 18, 1999)**
Geographic Coverage:	**Rangewide**

Figure 1. County distribution of pigeon wings.



Pigeon wings is an erect perennial herb belonging to the pea family. The distribution of the species is limited mainly to the rapidly disappearing scrub habitat of the Lake Wales Ridge in Highlands and Polk counties. Loss of habitat to agriculture and residential development resulted in the listing of this species. Like most other imperiled scrub plants, habitat acquisition and implementation of proper land management techniques are needed to ensure the continued survival of the pigeon wings.

This account represents a revision of the existing recovery plan for the pigeon wings (FWS 1996).

Description

The pigeon wings (*Clitoria fragrans*) is a 15 to 100 cm tall, long-lived perennial herb with an erect habit. The thick horizontal root, which may grow to more than 2 m long, bears one to several purplish, glaucous, wiry, very straight stems. The somewhat leathery leaves consist of three leaflets. Leaflets of the upper leaves are obtuse at the tip and narrower than those of lower leaves (58 FR 25746).

Clitoria fragrans have chasmogamous (insect pollinating) and cleistogamous (self-pollinating) flowers. The chasmogamous flowers usually occur in pairs, each corolla consisting of one 3.5 to 4.5 cm-long (Fantz 1977) or 4.5 to 5 cm-long (Isely 1990) standard petal and a small white keel. The common name of this species refers to the petals of the chasmogamous flowers, which resemble wings (Fantz 1979). Pigeon wings plants are easily recognizable due to the inverted position of these pale purple flowers (Fantz 1979). The flowers are inverted so that the anthers and stigma touch the backs of visiting insects (the only other legume genus with inverted flowers is *Centrosema*, with two species in central Florida). The seed pod (legume) is 5 to 8 cm long and extends from the calyx (Fantz 1979). This species can be confused with *C.*

mariana but can be easily distinguished as *C. fragrans* has purplish, glaucous stems, non-twining habit, narrow leaflets, smaller flowers, and long-stipitate fruits (Fantz 1977). A detailed technical description is provided by Kral (1983).

Taxonomy

Clitoria fragrans was described and named from a Highlands County specimen in 1926 (Small 1926). The name *C. pinetorum* was recognized but never published (Fantz 1977). The North American *Clitoria* species were moved to the genus *Martiusia* by Small (1933), but were later transferred back to the genus *Clitoria* by Fantz (1977).

This herb's common name, pigeon wings, was derived because of its flowers' bird-like appearance (Fantz 1979). It is one of three species of the genus occurring in the southeastern United States. The others are the native butterfly pea *(C. mariana)* and a butterfly pea escaped from cultivation *(C. ternata)*.

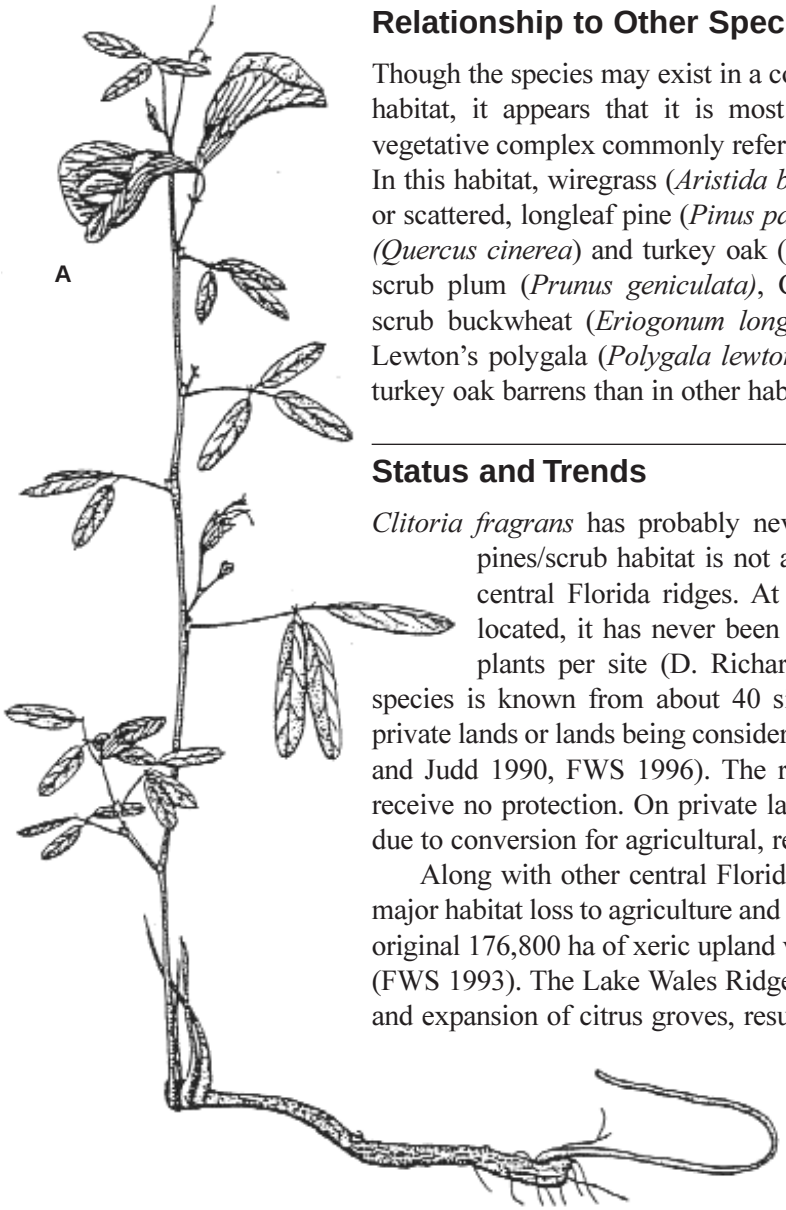
Distribution

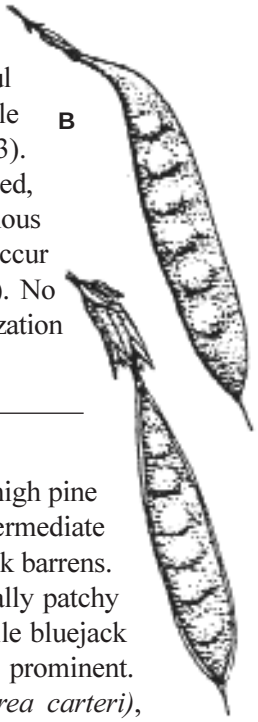
Clitoria fragrans is distributed along the Lake Wales Ridge primarily in Highlands, Orange, and Polk counties (Fantz 1977, Wunderlin *et al*. 1980, Christman 1988)(Figure 1). It was also found at one site in central Osceola County in 1964 and near Leesburg, Lake County in 1910 (Fantz 1977). It has not recently been reported from either historic locality.

Habitat

Some confusion exists with respect to the vegetative community inhabited by *C. fragrans.* Christman (1988) indicates that the species is found primarily within habitats intermediate with high pine and scrub. Christman and Judd (1990) reported the species from scrub, turkey oak barrens, and the edges of high pines. Others report *C. fragrans* from scrubby high pine, more typical of hickory-dominated scrub (hickory phase of high pineland)(E. Menges, Archbold Biological Station, personal communication 1997). This apparent disagreement indicates that more information is needed on the distribution of these plants. It also demonstrates the limits to developing and applying consistent terminology to describe a complex mosaic of vegetation.

There is also disagreement about the plant's preference for white sand soils versus yellow sand soils. As mentioned above, the species has been found in turkey oak barrens and scrub hickory, both of which occur on yellow sand soils. However, Fantz (1979) regards the pigeon wings as a species of white sand soils. The species has also been seen in white sand scrub at Carter Creek, Highlands County, and has been noted in the Lake Wales Ridge SF on both white (Archbold) and yellow (Tavares) sands (FWS 1996, C. Weekley, DACS Division of Forestry, personal communication 1998).





Pigeon wings.
Original drawings by Lisa C. Magahee.

A. plant
B. fruit

Reproduction

Clitoria fragrans has two kinds of flowers; the colorful chasmogamous flowers are pollinated by insects, while cleistogamous flowers are self-pollinating (FWS 1993). Cross-fertilization of cleistogamous flowers is prevented, since the flowers do not open (Fantz 1979). Chasmogamous flowers bloom from May to June. Cleistogamous flowers occur later in the summer through late September (FWS 1993). No information is available on the pollination vector, fertilization rate, seed production, or germination rates for this species.

Relationship to Other Species

Though the species may exist in a continuum of scrub to high pine habitat, it appears that it is most prevalent in an intermediate vegetative complex commonly referred to as the turkey oak barrens. In this habitat, wiregrass (*Aristida beyrichia*) may be locally patchy or scattered, longleaf pine (*Pinus palustris*) scattered, while bluejack *(Quercus cinerea*) and turkey oak (*Q. laevis*) are usually prominent. scrub plum (*Prunus geniculata)*, Carter's mustard (*Warea carteri)*, scrub buckwheat (*Eriogonum longifolium* var. *gnaphalifolium)*, and Lewton's polygala (*Polygala lewtonii)* also appear to be more common in the turkey oak barrens than in other habitats (Christman 1988).

Status and Trends

Clitoria fragrans has probably never been abundant since intermediate high pines/scrub habitat is not a major vegetative complex associated with central Florida ridges. At specific sites where *C. fragrans* has been located, it has never been found in large numbers; typically 20 to 30 plants per site (D. Richardson, personal communication 1995). The species is known from about 40 sites, 13 of which are protected public and private lands or lands being considered for acquisition and protection (Christman and Judd 1990, FWS 1996). The remainder of sites are on private lands and receive no protection. On private land, the species is threatened by habitat loss due to conversion for agricultural, residential and commercial uses.

Along with other central Florida scrub plants, *C. fragrans* has experienced major habitat loss to agriculture and residential development. Only 11,500 of the original 176,800 ha of xeric upland vegetation remains on the Lake Wales Ridge (FWS 1993). The Lake Wales Ridge continues to experience population growth and expansion of citrus groves, resulting in further destruction of scrub habitat. Other threats to *C. fragrans* include off-road vehicle use, trash dumping, and trampling (FWS 1993). *C. fragrans* is especially at risk because it is found in small, fragmented populations (Fantz 1979).

The total number of *C. fragrans* has been estimated to be less than 3,000 in Orange, Polk, and Highlands counties (Muller *et al.* 1989). Most populations are found on the Lake Wales Ridge in Highlands and Polk counties (Fantz 1977, Wunderlin *et al*. 1980, Christman 1988), where they are protected at Archbold Biological Station, Lake Wales Ridge SF and SP, Saddle Blanket Lakes, Lake Apthorpe, Tiger Creek, and at Bok Tower Gardens in the Ridge Pine Nature Preserve and in the surrounding natural buffer areas of the Gardens. The species can also be found at the Air Force's Avon Park Bombing Range, and at two areas undergoing active acquisition efforts (FWS 1993). The species may also exist in suitable, unsurveyed habitat within and adjacent to its known range.

Management

Florida scrub has historically experienced variable fire frequencies and patchy high-intensity fires (Myers 1990). Scrub plant communities are therefore fire-adapted, and recover relatively quickly (Abrahamson 1984). The fire ecology of the turkey oak barrens varies slightly from surrounding scrub and high pine. The irregular pattern of hills, valleys, and wetlands affects the frequency and magnitude of fires in this habitat. Periods of relatively frequent fires favor high pine species, while periods of infrequent fire favor scrub species. The result of this changing fire regime is a plant complex in which neither scrub nor high pine vegetation dominate.

Studies at Archbold Biological Station have documented positive post fire responses in flowering and vegetative growth of *C. fragrans* (Menges, Archbold Biological Station, personal communication 1997). Decreased flowering within one year after burning suggests fire suppression and canopy closure adversely affect this plant, resulting in reduced vegetative vigor and reproduction. However, the plant has been observed flowering in a location that had not been burned in 30 years, indicating that *C. fragrans* will persist for many years under suboptimal conditions. Even though plants may persist with infrequent fire, we believe that fire management is essential to the long-term survival of this species. *C. fragrans'* dependence on fire is particularly evident when considering the quick and profuse blooming in response to fire. Adequate management is still needed at many of the protected sites.

Several ongoing habitat acquisition efforts are intended to benefit *C. fragrans*, along with other threatened and endangered plant species in central Florida. Florida's Conservation and Recreation Lands program (CARL) and The Nature Conservancy are acquiring scrub land for preservation, and the FWS plans to add to Lake Wales Ridge NWR. Populations of *C. fragrans* will also benefit as the FWS undertakes protection of other federally listed plants and the endangered Florida scrub-jay (*Aphelocoma coerulescens*), an inhabitant of the scrub vegetation on Lake Wales Ridge. Critical habitat has not been designated for the pigeon wings, since designation could increase the risk of collection and/or extermination (FWS 1993).

The number and distribution of *C. fragrans* has been greatly reduced. It is clear that additional losses of habitat and individuals will occur as more than half of the known remaining sites are on private lands and are afforded no protection. Though protected sites represent a small fraction of the historic distribution of many endemic scrub plants, a number of *C. fragrans* sites are, or soon will be, protected by public and private purchase and conservation efforts. Although more than half of the remaining sites where this species occurs are still afforded no protection, current conservation efforts may be sufficient to ensure long-term survival of this plant. On those protected sites described above, land management efforts are targeting restoration and maintenance of scrub and high pine vegetative complexes. Management of other public scrub habitats will likely favor most endemic scrub plants, including *C. fragrans*. Management of scrub habitat on Avon Park AFR appears to be successful as many scrub endemics are responding well to their management activities. Monitoring of turkey oak barrens' response to fires regime and other management tools used in scrub and high pine habitats will help determine which techniques most effectively maintain the turkey oak barrens vegetative complex.

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Recovery for the Pigeon Wings

Clitoria fragrans Small

Recovery Objective: **DELIST** the species once recovery criteria are met**.**

Recovery Criteria

Clitoria fragrans may be delisted when: enough demographic data are available to determine the appropriate numbers of self-sustaining populations and sites needed to ensure 95 percent probability of persistence for 100 years; when these sites, within the historic range of *C. fragrans*, are adequately protected from habitat loss, degradation, and fragmentation; when these sites are managed to maintain the ecotone between xeric oak scrub and high pine that supports *C. fragrans*; and 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.

Species-level Recovery Actions

S1. **Determine current distribution of *C. fragrans.*** Some portions of *C. fragrans*'s range have been well surveyed, yet a total distribution has not been ascertained for this species. A thorough survey is needed to determine the distribution for this species.

S1.1. **Conduct surveys for additional populations of *C. fragrans*.**

S1.1.1. **Continue surveys in Polk and Highlands counties.** The Lake Wales Ridge has probably been adequately surveyed, though new sites for *C. fragrans* may still be found.

S1.1.2. **Continue surveys on protected lands.** New sites for listed species are still being found on protected lands. This survey work should be continued to catalog all existing protected sites and new sites as they are purchased.

S1.2. **Maintain distribution of known populations and suitable habitat in GIS database.** Use GIS to map existing populations and to assess the species' status and trends over time. The database should contain information on locations, population sizes, and status. This information should also be used for project review, in land acquisition activities, and to coordinate updates with the Florida Natural Areas Inventory database. Currently, the Lake Wales Ridge Ecosystem Working Group and Archbold Biological Station are proposing to map the entire central ridge. This information would show potential habitat for scrub endemics based on their habitat needs.

S2. **Protect and enhance existing populations.** Much of the native xeric uplands on the Lake Wales Ridge and surrounding counties have been converted to agriculture or urban development. The remaining habitat is fragmented into small parcels and in many cases, isolated. For this reason, existing populations are in need of protection from a variety of threats.

S2.1. **Acquire or otherwise protect privately owned habitat through acquisition, conservation easements, or agreements with landowners.**

S2.2. **Protect populations on public lands.** Develop management guidelines that allow for a fire regime that includes a mosaic of successional stages.

S2.3. **Use local or regional planning to protect habitat.** Utilize available regional and county planning processes to encourage protection of suitable habitat, both unoccupied and occupied of *C. fragrans*.

S2.4. **Continue *ex situ* conservation.** *Ex situ* collections are important for preserving genetic diversity, preventing extirpation, and determining ecological characteristics and habitat management needs of species. These collections will be instrumental in the recovery of *C. fragrans*.

S2.4.1. **Conserve germ plasm.** The seed for this species is not presently in long-term storage.

S2.4.2. **Maintain *ex situ* collection**. Currently, the Center for Plant Conservation coordinates conservation activities and maintains a database for the National Collection. Bok Tower Gardens, as a participating institution, maintains and propagates *C. fragrans* as part of the National Collection.

S2.5. **Enforce available protective measures.** Use local, State and Federal regulations to protect this species from overcollecting and damage from off-road vehicle use. Regulations should also be used to protect xeric vegetative communities where *C. fragrans* lives.

S2.5.1. **Initiate section 7 consultation when applicable.** Initiate section 7 consultations when Federal activities may affect this species.

S2.5.2. **Enforce take and trade prohibitions.** This species is protected by take provisions of the ESA (including its prohibition against removing and reducing to possession any endangered plant from areas under Federal jurisdiction; maliciously damaging or destroying any such species on any such area; or removing, cutting, or digging up any such species), by the Preservation of Native Flora of Florida Act, and by the Florida rules regarding removal of plants from State lands.

S3. **Conduct research on life history characteristics of *C. fragrans*.** Much of the basic biology and ecology of this species remains poorly understood. To effectively recover this species, more specific biological information is needed.

S3.1. **Continue research to determine demographic information, such as numbers of sites and populations, numbers of individuals in a population, recruitment, dispersal, growth, survival, and mortality.**

S3.2. **Once demographic data are known, conduct population viability and risk assessment analysis to determine the numbers of plants, sites, subpopulations/populations, and spatial distribution needed to ensure persistence of the species.**

S3.3. Conduct research to assess management requirements of *C. fragrans*. Determine which natural populations can be stabilized or increased by habitat management. Surveys, research, and monitoring information will provide factors contributing to any declines at each site. Monitoring of populations should be in reference to various habitat management practices. Site-specific management guidelines should be provided to land managers and close coordination among land managers is essential to develop adaptive management techniques.

S4. Monitor populations of *C. fragrans*.

S4.1. Develop monitoring protocol to assess population trends for *C. fragrans*.

S4.1.1. Monitor to detect changes in demographic characteristics, such as reproduction, recruitment, growth, dispersal, survival, and mortality. Also monitor for pollinators, herbivory, disease, and injury.

S4.1.2. Monitor the effects of various land management actions on *C. fragrans*. Assess any changes in demographic characteristics of *C. fragrans* in response to land management activities, such as prescribed fire, exotic plant control, *etc.*

S4.2. Develop a quantitative description of the population structure of *C. fragrans*. This description will provide a baseline for monitoring population dynamics in response to natural environmental changes and management treatments. Data recorded should include morphology, survivorship, mortality, and reproduction for individual plants. Data about each plant's microsite (vegetation cover, litter depth, substrate, and closest neighbors) should also be included.

S5. Provide public information about *C. fragrans*. It is important for the recovery of this species that governmental agencies, conservation organizations such as the Florida Native Plant Society, and private landowners be appropriately informed about this species. Care is needed, though, to avoid revealing specific locality information about where *C. fragrans* is found.

Public outreach efforts must also continue to address the increasing concern that horticultural demand for this and other rare species may not benefit conservation of threatened and endangered species. Public education should identify that commercial production and horticultural uses of endangered species provide little benefit to species, since the recovery of *C. fragrans* and other rare species requires a self-sustaining, secure, number of natural populations.

Habitat-level Recovery Actions

H1. Prevent degradation of existing habitat. Extensive habitat loss, degradation, and fragmentation have already occurred throughout the range of this species. Both urbanization and fire suppression have decreased the available habitat. To date, there are eight protected sites for *C. fragrans* in Polk and Highlands counties.

H1.1. Secure habitat through acquisition, landowner agreements, and conservation easements. With so little xeric scrub habitat left, any method of securing protected populations should be sought.

H1.2. Manage and enhance habitat. Manage habitat to maintain *C. fragrans* populations by preventing damage from off-road vehicle use, and overcollection, and by providing proper management of habitat, including prescribed fire.

H1.2.1. Conduct prescribed burns. Fire is a necessary and integral characteristic of the scrub community. A variable interval in fire return and in season is important to mimic the natural fire regime. In addition, spatial variation in fire intensity and unburned patches is necessary to construct a natural fire landscape. The scrub is naturally made up of islands of suitable and unsuitable habitat. To repeat this landscape pattern, sites should be burned as a mosaic when possible to allow for variation.

H1.2.2. Control and eliminate exotic and invasive plants and animals. Exotic plant and animal species are not yet a major threat in Florida scrub as compared to other communities in South Florida. However, in isolated areas, exotic species are becoming established. Without control, exotic/invasive plants may become a threat to the survival and recovery of *C. fragrans.*

H1.2.3. Control access to areas where listed plants are growing. Collection, trampling, and off-road vehicles can severely threaten individual populations.

H2. Restore areas to suitable habitat. Native habitats that have been disturbed or that have experienced a long history of fire suppression may be good candidates for future reserves. Rehabilitation of a site may be a lengthy process, but with fewer and fewer sites remaining, these sites may become more valuable for future recovery. On these sites a seed bank may exist that could include rare endemic species.

H2.1. Restore natural fire regime. Long periods without fire can change the species composition and the ability of the site to carry fire.

H2.2. Enhance sites with native plant species. Because of logging or long periods without fire, certain native plant species that were present historically may now be absent from the natural composition of the community. These species can be reintroduced if natural colonization is not possible.

H3. Conduct habitat-level research projects. Study the response of *C. fragrans* to various land management practices, such as prescribed fire regimes, vegetative thinning, and control of exotic/invasive vegetation.

H4. Monitor habitat/ecological processes. Monitor the effects of land management actions, such as prescribed fire, exotic plant control, *etc.*, on the habitats where *C. fragrans* occurs.

H5. Provide public information about scrub and its unique biota. Educational efforts, especially those conducted by Archbold Biological Station, have been successful. Without these successful efforts, the Lake Wales Ridge NWR would not have been created. Florida's system of biological preserves depends on a broad base of public understanding and support for its funding and future success. In addition to past and ongoing educational efforts by The Nature Conservancy, Bok Tower Gardens, and Archbold Biological Station, future efforts by these organizations, and the Florida Park Service, the Florida Division of Forestry, the SFWMD, the Florida Native Plant Society, and local garden clubs are crucial in increasing public appreciation of scrub and high pine communities, and their associated plant species. The Arbuckle Appreciation Day sponsored by the Florida Division of Forestry has been especially successful in disseminating knowledge about these unique communities.