

**Avon Park Harebells
(*Crotalaria avonensis*)**

**5-Year Status Review:
Summary and Evaluation**



Photo credit: Christine Sit, Archbold Biological Station

**U.S. Fish and Wildlife Service
Southeast Region
Florida Ecological Services Field Office
Gainesville, Florida**

June 2023

STATUS REVIEW
Avon Park harebells, (*Crotalaria avonensis*)

GENERAL INFORMATION

Current Classification: Endangered

Lead Field Office: Florida Ecological Services Field Office, David Bender, (772) 562-3909

Reviewers:

Lead Regional Office: Southeast Region, Carrie Straight, (404) 679-7226

Methodology used to complete the review

In accordance with section 4(c)(2) of the Endangered Species Act of 1973, as amended (Act), the purpose of a status review is to assess each threatened species or endangered species to determine whether its status has changed and if it should be classified differently or removed from the Lists of Threatened and Endangered Wildlife and Plants. The U.S. Fish and Wildlife Service (Service) evaluated the biology, habitat, and threats of the Avon Park harebells to inform this status review.

We announced initiation of this review in the Federal Register on August 6, 2019 (84 FR 38291) with a 60-day comment period. We did not receive any public comments related to this species during the comment period. This review was contracted to the Texas A&M University Natural Resources Institute. The literature and data used for the writing of this review was provided by the Florida Ecological Services Field Office (FESFO). No structured decision-making process was used, as most sections were adapted and updated from the previous review for this species (2007). This review was reviewed and completed by the Service's FESFO, Gainesville, Florida. All literature and documents used for this review are on file. All recommendations are those of the Service and the result of thoroughly reviewing the best available information on Avon Park harebells (*Crotalaria avonensis*).

Federal Register Notice citation announcing initiation of this review: August 6, 2018 (84 FR 38291)

Species' Recovery Priority Number (RPN) at start of 5-year review (48 FR 43098): The current RPN for the species is categorized as a 5c indicating it is a species with a high degree of threat and a low recovery potential with a degree of conflict between the species recovery and development or some other economic interest.

Review History: A previous 5-year review was completed in 2007 which recommended no change in status and change in RPN from 2c to 5c (Service 2007).

REVIEW ANALYSIS

Listed Entity

Taxonomy and nomenclature

The taxonomy of the listed entity is still valid (Integrated Taxonomic Information System 2023). The species is currently identified as *Crotalaria avonensis* DeLaney & Wunderlin. We are unaware of any taxonomic issues with this species.

Distinct Population Segment (DPS)

The Act defines species as including any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate fish and wildlife. The definition limits listing DPS to vertebrate species of fish and wildlife and because this species is a plant, the DPS policy does not apply.

Recovery Criteria

Recovery Plan

Crotalaria avonensis is included in the South Florida Multi-Species Recovery Plan (MSRP) Although the original plan, issued on May 18, 1999, did not include delisting criteria. The Lake Wales Ridge Plants Recovery Plan Amendment contains delisting criteria for this species. This amendment was published on September 27, 2019.

Recovery plans are not regulatory documents and are intended to provide guidance to the Service, states, and other partners on methods of minimizing threats to listed species and on criteria that may be used to determine when recovery is achieved. If the recovery criteria defined in the plan are still valid, meeting recovery criteria can indicate that the species no longer requires protections under the Act. However, when recommending whether a listed species should be delisted, the Service must apply the factors in section 4(a) of the Act ([84 FR 45020](#)).

South Florida Multi-Species Recovery Plan (MSRP)

The MSRP recognized that for stabilization of the species existing populations, within the historic range of *C. avonensis*, should be adequately protected from further habitat loss, degradation, and fire suppression. In addition, sites of existing population should be managed to support the species. None of the criteria have been met. The privately owned Avon Park Lakes site, site with the largest population, is not managed and the use of fire as a management tool remains difficult even for sites that are not privately owned.

Lake Wales Ridge Plants Recovery Plan Amendment

The Lake Wales Ridge Plants Recovery Plan Amendment lists four recovery criteria that need to be met to consider Avon Park harebells for delisting.

1. At least 20 populations exhibit a stable or increasing trend, evidenced by natural recruitment and multiple age classes.
2. Populations (as defined in criterion 1) in yellow sand scrub and scrubby flatwoods habitats are distributed across the known range of the species.

3. Populations are protected and managed via a conservation mechanism to a degree that enough suitable habitat is present for the species to remain viable for the foreseeable future.

The Avon Park harebells has a very narrow known historical distribution (Service 2007 and references therein). There are currently only four populations of Avon Park harebells, one of which is an introduced population. In 2012, 400 seeds and 84 transplants of *C. avonensis* were introduced to a site within management unit SL8 of the Silver Lake Tract of the Lake Wales Ridge Wildlife and Environmental Area (LWRWEA) (Smith et al. 2013, pp. 22, 25) (Figure1). The site included both scrubby flatwoods and rosemary scrub, both being vegetation types with which the presence of Avon Park harebells is most often associated (Smith et al. 2013, p. 20).

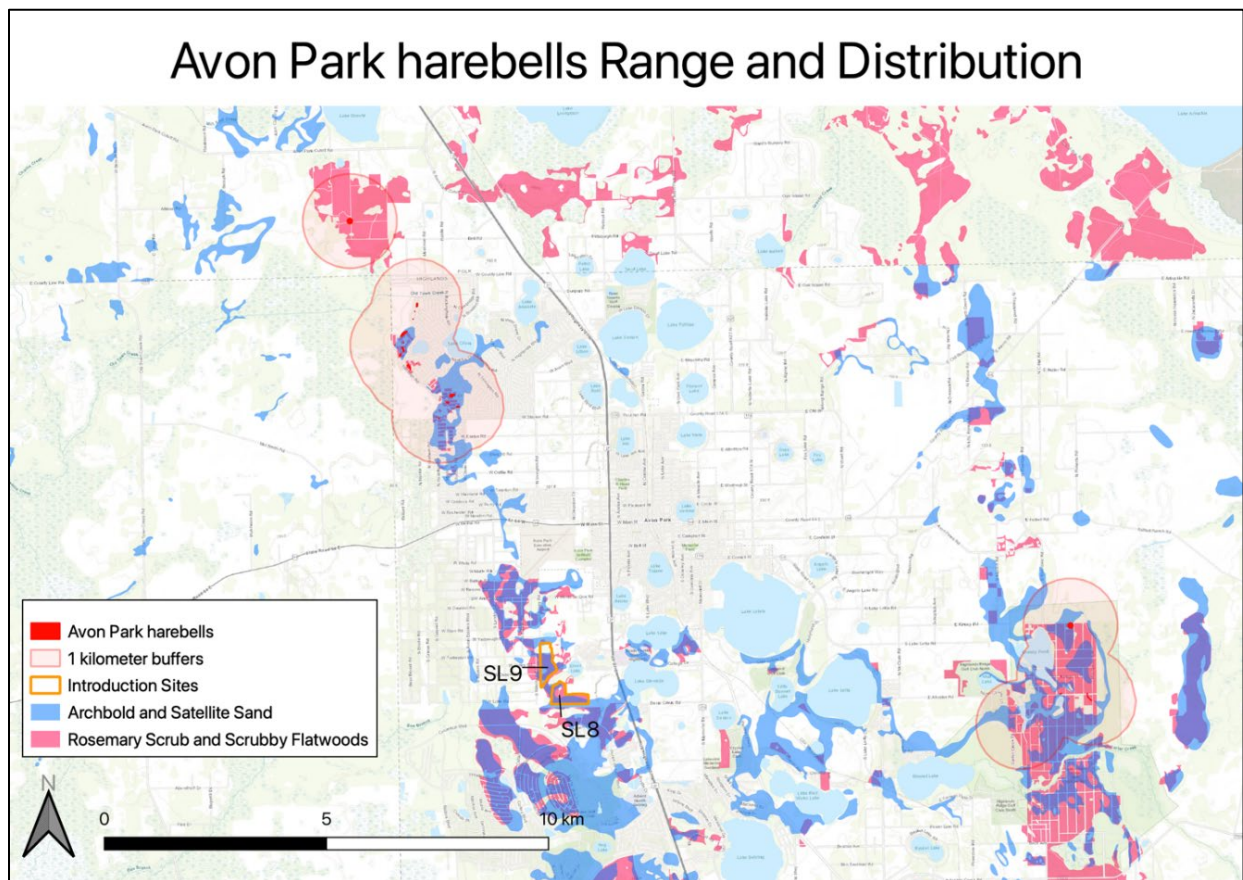


Figure 1. Map of occurrences of Avon Park harebells. Also depicted are the boundaries of management units selected for introduction efforts and soil and vegetation types which are favorable to the species (Soil Survey Staff 2021, CLC 2019, and Smith et al. 2013). The Saddle Blanket Scrub Preserve subpopulation is located furthest to the northwest, the Avon Park Lakes population is just southeast of it, and the Carter Creek population is near the southeast corner of the map.

Biology and Habitat Summary

For the purposes of this review, populations were defined using 1 km buffers around documented plant locations, as shown in Figure 1. Currently, there are three recognized natural concentrations of Avon Park harebells plants and a reintroduced population.

1. Avon Park Lakes population
2. Saddle Blanket (considered a subpopulation of Avon Park Lakes)
3. Carter Creek population
4. Lake Wales Ridge Wildlife and Environmental Area (introduced)

In the most recent data, the Florida Natural Areas Inventory (FNAI) Element Tracking Summary (FNAI 2015) identified six occurrences of Avon Park harebells, with two corresponding to each of the three populations/subpopulations in Polk and Highlands counties, Florida. In general, the populations declined in numbers from 2005 to 2008, but have remained stable or increased slightly until 2015 (TNC 2009, p. 3; Smith et al. 2013, p. 4; Menges et al. 2016, p. 558). The plant densities at sites representing the Avon Park Lakes population and Saddle Blanket subpopulation were not statistically different, but densities of the Carter Creek population were significantly higher (Menges et al. 2016, p. 558).

The only notable changes in the distribution of Avon Park harebells since the previous 5-year review include a 2012 introduction and the 2015 introduction. These introductions were placed within management units SL8 and SL9 (respectively) of the Silver Lake Tract of the Lake Wales Ridge Wildlife and Environmental Area (LWRWEA) (Smith et al. 2013, pp. 20-21; Menges and Smith 2016, p. 3) (Figure 1). Although these locations are outside of the known historical range based on collection records, knowledge of past distribution of the species' habitat and the presence of suitable habitat suggest that the species would have also occurred in these locations.

In 2012 translocation, 400 seeds and 84 transplants of *C. avonensis* were introduced to a site within management unit SL8 of the Silver Lake Tract of the LWRWEA (Smith et al. 2013, pp. 22, 25). The site included both scrubby flatwoods and rosemary scrub, both being vegetation types with which the presence of Avon Park harebells is most often associated (Smith et al. 2013, p. 20). The introduction effort included experimental treatment of seeds to determine whether scarification of the seed coat improved germination rates. As of June 2015, 46% of these seeds had germinated, with no significant difference between scarified and unscarified seeds. The transplants introduced to this site included tissue-cultured plants, cuttings from tissue-cultured plants, and cuttings from wild plants. The cumulative (2012-2015) survival rate of the transplants was 44.6%, with 100% survival from 2014-2015. Six seedlings along with 25% of transplants have flowered for at least one season, and nine of the transplants have successfully produced fruit as of 2015. In addition, a new seedling recruit was documented near one of the transplants in June 2015, indicating the successful reproduction of introduced plants (Menges et al. 2015, p. 46).

The introduction in management unit SL9 of the Silver Lake Tract of the LWRWEA, also contained both scrubby flatwoods and rosemary scrub vegetation types (Menges and Smith 2016, p. 3). All seeds were left unscarified, but 400 were assigned a new suite of experimental treatments to evaluate the effects of seed burial and supplemental litter cover. As of June 2016, the seeds had germinated at an overall rate of 9.5%, and 69% of the resulting seedlings had survived. Preliminary results have not allowed for an analysis of experimental treatment effects,

but buried and covered seeds had shown much greater germination (Menges and Smith 2016, pp.1-2).

As a species, Avon Park harebells continues to exhibit low fecundity and recruitment, with relatively low rates of flower, fruit, and seed production (Menges et al. 2016, p. 561). There has also been a decreasing trend in occupancy at studied sites, despite 15 percent of plots being found to be reoccupied in later samples (Menges et al. 2016, p. 558).

Threats (Five-Factor Analysis) Summary

The status of a species is determined from an assessment of factors specified in section 4 (a)(1) of the Act, including: Factor A: the present or threatened destruction, modification, or curtailment of its habitat or range; Factor B: overutilization for commercial, recreational, scientific, or educational purposes; Factor C: disease or predation; Factor D: the inadequacy of existing regulatory mechanisms; Factor E: other natural or manmade factors affecting its continued existence. A summary of this assessment is detailed below.

The primary threat to Avon Park harebells in regard to Factor A is still land development. Projections expect an increase of up to 23 percent in the amount of developed land in central Florida, bringing the total to almost half of the land in the region (Carr and Zwick 2016, p. 23). While development directly decreases the amount of available habitat, it can also decrease the ability of land managers to utilize prescribed fire as a tool for maintaining the types of habitats in which Avon Park harebells are most often found (Melvin and McIntyre 2017, entire; Service 2019, p. 3). Development is also often associated with an increase in the use of various types of pesticides. The components of these pesticides can have a range of effects on insect pollinators, from inhibition of neurological or immune function to lethal outcomes (Sponsler et al. 2019, pp. 1020-1021). The loss of pollinators could be potentially devastating for Avon Park harebells, as they are dependent on pollination for successful reproduction (Menges et al. 2016, p. 562).

We have not acquired/are not aware of any information to indicate that overutilization for commercial, recreational, scientific, or educational purposes (Factors B) is considered a threat. Although there was some concern related to impacts from scientific studies might be impacting the species, we do not have evidence indicating that long-term ecological studies are negatively impacting Avon Park harebells or its habitat

Herbivory (under Factor C) has been shown to affect around 16 percent of plants annually, but these rates are highly variable between years (Menges et al. 2016, p. 565). The reduction of herbivory using protective cages around plants was also found to provide significant positive effects on survival, growth rates, and flowering, indicating that herbivory is a significant threat to Avon Park harebells (Menges et al. 2016, p. 566).

Regulatory mechanisms are considered inadequate to protect the species and its habitat (Factor D). Of the current populations three of four occur on protected lands, which prevent development. However, as described above even on protected lands, inadequate management such as the inability to use prescribed burning to maintain habitat threatens the species throughout the range. There is no regulatory mechanism that will fully protect the habitat from all sources of habitat modification or the species from threats identified under Factor E below.

The previous review identified the use of off-road vehicles as a serious threat under Factor E due to the crushing of plants and soil disturbance associated with this activity (Service 2007, p. 14). This threat has reduced intensity at Carter Creek, thanks to the addition of fencing to the site in 2008 (Menges et al. 2016, p. 568). However, climate change has been identified as an additional threat under Factor E. Climate projections for Florida show a general warming trend, along with a trend towards more variable rainfall patterns (Karl et al. 2009 as cited in Foster et al. 2014, p. 226). Temperatures have already shown increases in the 20th century and is expected to continue in the future and result in more extreme droughts (Runkle et al. 2022, entire). Therefore, longer and more intense droughts are expected, particularly during the spring (Foster et al. 2014, pp. 231-232), when Avon Park harebells need water to resprout, flower, and seed (DeLaney and Wunderlin 1989, p. 319). The warmer and potentially drier conditions associated with climate change are also expected to reduce the use of prescribed fire as a tool for maintaining scrub habitats (Kupfer et al. 2020, p. 769), which are important areas for Avon Park harebells (Service 2019, p. 3).

In addition to these threats, the isolated nature of the populations and their habitat, low recruitment, and low numbers of individuals in populations increase the species' risk of extinction from the threats described above. The very narrow range of the species and limited recruitment may also suggest that the species has already experienced losses in genetic variation and could be experiencing negative consequences of those impacts.

Synthesis

Avon Park harebells is a spreading, perennial herb endemic to the Lake Wales Ridge in Florida. It remains a very narrowly distributed species with only three natural populations and two relatively recent introductions all located within two counties of central Florida. The abundances of these populations are small, with the species generally exhibiting low reproductive effort. Given these characteristics, Avon Park harebells is vulnerable to threats including further isolation of populations and catastrophic events that could impact several or all populations. Development is still the primary threat facing Avon Park harebells, having both direct and indirect effects on the quantity and quality of available habitat (Factor A). The conversion of scrub habitat into residential or agricultural land not only directly eliminates potential habitat for Avon Park harebells, it is also expected to contribute to greater fire suppression and result in reduced use of prescribed fire in surrounding areas, which can lead to much lower habitat quality. Since the previous review, herbivory has been identified as an additional potential threat (Factor C), as it can affect 16 percent of plants each year, and has been shown to reduce survival, growth rates, and flowering. Another newly identified threat to Avon Park harebells is climate change (Factor E). Projections show trends towards a warmer climate in central Florida, with more unpredictable rainfall patterns including an increased propensity towards droughts, particularly during spring. As most of the growth and reproduction of Avon Park harebells occurs during spring, this has the potential to become a serious threat. These trends towards periods of warmer, drier conditions are also expected to reduce the use of prescribed fire as a tool for maintaining the scrub habitats upon which Avon Park harebells depend. Given the status of the species and the threats facing it, its classification should remain as endangered.

RECOMMENDED FUTURE ACTIVITIES

Recovery Activities

- Continue applying prescribed fire when possible to maintain scrub habitat for Avon Park harebells.
- Conduct further augmentation and introduction projects to expand the range of the species and increase the number of populations.
- Acquire land within the range of Avon Park harebells and restore scrub habitat to these areas.

Monitoring / Research Activities

- Develop a consistent monitoring protocol to occur at regular intervals in areas that are occupied by Avon Park harebells and are accessible for survey.

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RESULTS / SIGNATURES

U.S. FISH AND WILDLIFE SERVICE 5-YEAR STATUS REVIEW of Avon Park harebells (*Crotalaria avonensis*)

Current Classification: Endangered

Status Recommendation:

On the basis of this review, we recommend the following status for this species. A 5-year review presents a recommendation of the species status. Any change to the status requires a separate rulemaking process that includes public review and comment, as defined in the Act.

- Downlist to Threatened
- Uplist to Endangered
- Delist:
 - The species is extinct*
 - The species does not meet the definition of an endangered or threatened species*
 - The listed entity does not meet the statutory definition of a species*
- No change needed

FIELD OFFICE APPROVAL:

**Division Manager, Classification and Recovery, Florida Ecological Services Field Office,
Fish and Wildlife Service**

Approve _____

** Since 2014, in the Florida Ecological Services Field Office, the Classification and Recovery Division Manager has delegated authority to approve 5-year reviews that do not recommend a status change.*