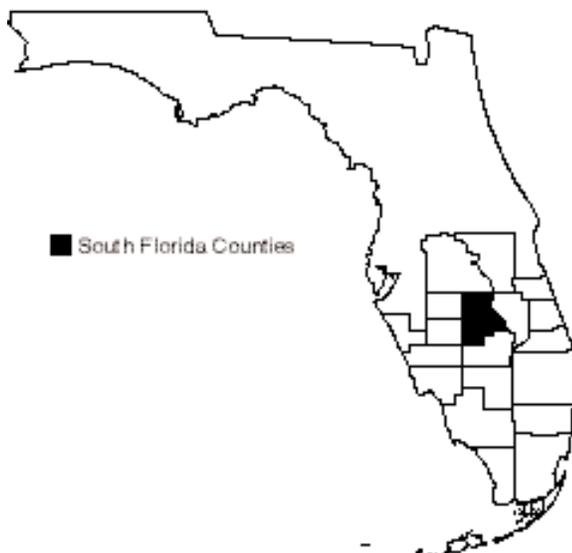

Garrett's Mint

Dicerandra christmanii Huck and Judd

Federal Status:	Endangered (Sept. 21, 1989)
Critical Habitat:	None Designated
Florida Status:	Endangered
Recovery Plan Status:	Revision (May 18, 1999)
Geographic Coverage:	Rangewide

Figure 1. County distribution of Garrett's mint.



Garrett's mint is a small, fragrant suffrutescent shrub that inhabits the scrub of central peninsular Florida. Due to *Dicerandra christmanii*'s strong resemblance to the scrub mint (*Dicerandra frutescens*) it was originally classified as scrub mint. It can be differentiated from the scrub mint by its scent, leaf size, and color of its flowers. Loss of habitat to residential and agricultural development (particularly for citrus groves), as well as fire suppression in tracts of remaining habitat, are the principal threats to this species.

This account represents a revision of the existing recovery plan for the Garrett's mint (FWS 1987).

Description

Dicerandra christmanii is a small, fragrant shrub that reaches 50 cm in height (Huck *et al.* 1989). Both its floriferous and vegetative shoots are stiff and ascend from a ramose (many branched, branching), woody base. Its taproot is branched with extensive, spreading, fibrous roots.

The leaves of Garrett's mint are sessile and have rounded apices, cuneate bases, entire margins and glandular-pitted upper and lower surfaces (Huck *et al.* 1989). Leaves found on the determinate, flowering shoots are narrowly ovate to narrowly oblong. Those that subtend the cymes are 2 to 8 mm long and 0.5 to 1.8 mm wide, while those that do not subtend the cymes are approximately 5 to 11 mm long, and 1 to 2.5 mm wide. The leaves of overwintering, vegetative shoots are similarly shaped, but larger.

The inflorescence is a verticillaster (Huck *et al.* 1989), with each cyme containing 1 to 3 flowers. The calyx is 6.5 to 10 mm long, approximately 2 mm wide (at midpoint), and bordered with an indistinct white band. The corolla is funnel shaped and abruptly bent to about 90 degrees. Its tube is 7 to 10 mm long, and its limb (from geniculum to distal edge of upper lobe) is 5 to 10 mm long. The corolla buds yellow, but at maturity, it is a pale cream (eventually fading to white). It has vivid purple-red markings that are often trellise-patterned

on the upper lobe, but irregularly spotted on the lower lobe. The upper lobe is a recurving, cleft standard, and the lower lobe is tripartite (three parted) with a recurving middle petal.

The flowers have four, paired stamens, which are exerted slightly beyond the lower corolla lip (Huck *et al.* 1989). The filaments are white, the anther sacs are brilliant yellow, and the connective is widened and may be covered with a few small, reddish and yellow glands at the basal end. The pollen is white and sticky. The pistil is white and has a slender, hirtellous style. The fruit is a schizocarp of four ovoid, brown, smooth nutlets.

Dicerandra christmanii is very similar in appearance to another *Dicerandra* species, *D. frutescens*. The two species are separated using the following characteristics. One, *D. frutescens* has a minty aroma, whereas *D. christmanii* smells of menthol (Huck *et al.* 1989). Two, the leaves of *D. frutescens* are longer than those of *D. christmanii* (Huck *et al.* 1989). Three, the anthers of *D. frutescens* are deep purple to white in color, while the anthers of *D. christmanii* are a brilliant yellow (Huck *et al.* 1989). Four, the corolla of *D. frutescens* fades from a cream color to a white within 1 to 3.5 hours of anthesis, while the corolla of *D. christmanii* retains its cream color throughout most of the first day of anthesis (Huck *et al.* 1989). Five, the anther connectives of *D. frutescens* have more, and larger, glands than those of *D. christmanii* (Huck *et al.* 1989).

Taxonomy

Specimens of *D. christmanii* were first collected by Garrett in 1948 east of Sebring and originally identified as *D. frutescens* by Ward (1979), Wunderlin (1984), and Huck (1987). *D. christmanii* was named as a distinct species in 1989 (Huck *et al.* 1989).

Distribution

Dicerandra christmanii has an extremely small range. It is known from five populations, all in Highlands County (Huck *et al.* 1989). These populations are located between Lake Jackson and Lake Istokpoga (FNAI 1996), 10.5 km north of the range of *Dicerandra frutescens* (Huck *et al.* 1989) (Figure 1). Interestingly, a slight break in the ridge occurs between the ranges of the two species at Josephine Creek (Huck *et al.* 1989).

Habitat

Dicerandra christmanii is found within openings in sclerophyllous oak scrub (Huck *et al.* 1989). As a “gap” species, it prefers open areas and does not grow vigorously when in shaded conditions. The species occurs on well-to excessively drained yellow sands of Astatula and Tavares soil types and is found where the seasonal high water table is at least 1 to 2 m deep.

Reproduction

Dicerandra christmanii flowers from July to November, primarily in September and October (Huck *et al.* 1989). Like other *Dicerandra* species, it has spurred

Garrett's mint flower.
Original photograph by Steve Shirah.



anthers which must be triggered by insects for the pollen to be released and dispersed (FWS 1987). This pollination process occurs mainly through bee-flies (*Exoprosopa fasciata*), and few other insects visit the plant (Huck *et al.* 1989).

The seeds do not have mechanisms for wind dispersal and generally fall close to the plant (R. Huck, personal communication, 1996). Some *Dicerandra* species have been shown to use water as a dispersal agent, sometimes having their seeds carried by streams (Huck 1987). However, the limited distributions of *D. christmanii*, *D. frutescens*, and *D. immaculata* indicate that this mechanism is not effective in South Florida. Given this limited dispersal, colonization of a newly disturbed area by *D. christmanii* depends on whether or not it is present in the seedbank. The lifespan of seeds in the seedbank is unknown.

Relationship to Other Species

Garrett's mint is frequently visited by its pollinators, bee-flies, but seldom by other insects. Like other *Dicerandra* species, it contains essential oils which protect it from feeding animals (McCormick *et al.* 1993). Interestingly, the chemical composition of the essential oils in *D. christmanii* is much different than that of *D. frutescens*, *D. immaculata* and *D. cornutisma* (McCormick *et al.* 1993). This explains the distinct difference in odor between Garrett's mint and the other *Dicerandra* species.

Though the interaction has not been observed, Garrett's mint may be susceptible to feeding Pyralid moths. These are the only insects known to feed on scrub mint (Eisner *et al.* 1990), so they may be consumers of Garrett's mint as well.

Status and Trends

Dicerandra christmanii was listed as endangered on September 21, 1989 (54 FR 38947). It had originally been classified as *D. frutescens* and was protected under that earlier listing. Loss of habitat to residential and commercial development, compounded by an extremely small distribution, threatens this species.

The principal site for *D. christmanii* is Flamingo Villas, an unbuilt subdivision adjacent to Sebring Airport. At present, it is the only protected site for the species, and the remaining lots in the area are the highest priority for acquisition for the Lake Wales Ridge National Wildlife Refuge. As of November 1995, the FWS had arrived at contracts on 698 of the 1,028 interior lots and 14 of the 30 lots facing State Road 623.

Although habitat loss is the primary threat to Garrett's mint, there are other factors that endanger its survival. The suppression of fire has limited the number of clearings available for the growth of gap species like *D. christmanii*. Also, dumping of trash and off-road vehicular traffic has resulted in erosion of habitat and trampling of individuals. This is of particular concern at Flamingo Villas, where management of the property is urgently needed to combat the rapidly increasing off-road vehicle use, trash dumping, and exotic plant invasion (FWS 1996).

Management

No research has been conducted on the response of *D. christmanii* to management practices. However, research on this subject has been completed for *D. frutescens*, and *D. christmanii* is likely to respond in a similar manner (E. Menges, Archbold Biological Station, personal communication 1997). This research can, therefore, serve as a guideline for management of *D. christmanii*.

Periodic fire appears to benefit *D. frutescens*, as colonies found in areas burned within the last 10 years exhibit the most vigorous growth (Menges 1992). Though growth appears most vigorous during this period, it has not been demonstrated to be the optimum frequency of disturbance. In fact, scrub mint may not be sensitive to burning frequency, as it is found in areas that were last burned as recently as 3 and as long as 65 years ago.

Based on the response of scrub mint, Garrett's mint should require a burning or alternative disturbance regime to maintain the quality of its habitat. In addition, fencing of sites is needed to protect the habitat from trash dumping and erosion due to off-road vehicle use. *D. christmanii* is vulnerable to trampling and vehicular traffic and is adversely affected by such impacts.

Archbold Biological Station has integrated research into the conservation biology of *D. christmanii* with monitoring efforts (FWS 1996). The breeding system, pollinators, demographic patterns, and genetic variability (through enzyme electrophoresis) are being investigated (FWS 1996). In addition to this research, experimentation with small-scale fire management is needed.

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Recovery for the Garrett's Mint

Dicerandra christmanii Huck and Judd

Recovery Objective: STABILIZE, then reclassify to threatened

Recovery Criteria

Dicerandra christmanii may be considered stabilized when existing populations, within the historic range of *D. christmanii*, are adequately protected from further habitat loss, degradation, and fire suppression. These sites must also be managed to maintain xeric oak scrub to support *D. christmanii*.

Once the existing populations are stabilized, *D. christmanii* may be considered for reclassification to threatened status. Reclassification will be considered when: enough demographic data are available to determine the appropriate numbers of self-sustaining populations required to ensure 20 to 90 percent probability of persistence for 100 years; when these populations, within the historic range of *D. christmanii* are adequately protected from further habitat loss, degradation, and fire suppression; when these sites are managed to maintain the seral stage of xeric oak scrub that supports *D. christmanii*; and when monitoring programs demonstrate that these sites support sufficient population sizes, are distributed throughout the historic range, and are sexually or vegetatively reproducing at sufficient rates to maintain the population.

This recovery objective is an interim goal because of the limited data on the biology, ecology, and management needs of this species. The recovery objective will be reassessed annually based on new research, management, and monitoring information. Delisting criteria may be defined if new information identifies ways of re-establishing populations of this species to expand its current distribution within its historic range.

Species-level Recovery Actions

- S1. Determine current distribution of *D. christmanii*.**
 - S1.1. Conduct surveys for additional populations of *D. christmanii*.**
 - S1.1.1. Continue surveys in Highlands County.** Though the range of this species has been thoroughly surveyed, it should be periodically re-surveyed to learn the status of the species on private lands.
 - 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, unoccupied, and occupied habitat of *D. christmanii*.
- 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 *D. christmanii*.
- 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 *D. christmanii* 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 *D. christmanii* 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.
- S2.6. Augment natural populations of *D. christmanii*.** Augmentation of populations on protected land is appropriate because there is little prospect for protecting additional sites.
- S2.6.1. Establish a protocol for reintroduction.** Records for source plants, techniques for establishing new populations, and protocols for monitoring are needed.

- S2.6.2. Locate potential (re)introduction sites.** Survey habitat within the historic range of *D. christmanii* and identify protected lands, both public and private, that would be suitable habitat.
- S2.6.3. (Re)introduce plants to protected sites.** Use plants under cultivation to (re)establish plants in suitable habitat.
- S3. Continue research on life history characteristics of *D. christmanii*.** Although recent work on *D. christmanii* can be used to infer answers to some life history questions, 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, pollinators, dispersal, growth, survival, and mortality.**
- S3.2. Assess genetic variability in the *Dicerandra*.** Work on this topic is underway. *Dicerandra* species are taxonomically difficult to distinguish without genetic work.
- S3.3. 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.**
- S3.4. Conduct research to assess management requirements of *D. christmanii*.** Determine which natural populations can be stabilized or increased by habitat management. Surveys, research, and monitoring information on the localities of *D. christmanii* 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 existing populations of *D. christmanii*.**
- S4.1. Develop monitoring protocol to assess population trends for *D. christmanii*.**
- 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 *D. christmanii*.** Assess any changes in demographic characteristics of *D. christmanii* in response to land management activities, such as prescribed fire, exotic plant control, *etc.* At present, the burn frequency for this species is unknown. Though *D. christmanii* grows more vigorously in areas burned within the last 10 years, it can be found in areas that were last burned from 3 to 65 years ago. More information is needed on the role of fire for this species.
- S4.2. Develop a quantitative description of the population structure of *D. christmanii*.** 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) may prove valuable in future management actions.

- S4.3. Monitor re-introduced plants.** Monitoring of reintroduced plants will be essential for assessing the status of new plants and their contribution to the population as a whole. Compare adult survival, seed production, germination rates, seed survival, seedling survival, and growth rates between transplanted plants and natural plants. Where monitoring indicates that the introduction has been unsuccessful, reevaluate protocol and methodology.
- S5. Provide public information about *D. christmanii*.** 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. However, caution should be taken to avoid revealing specific locality information of *D. christmanii*.
- 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 *D. christmanii* 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 is one protected site for *D. christmanii*.
- 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 *D. christmanii* populations by preventing habitat damage from off-road vehicle use and over collection 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. *D. christmanii* is experiencing competition from tall grasses. Without control, exotic/invasive plants may become a threat to the survival and recovery of *D. christmanii*.
- H1.2.3. Control access to areas where listed plants are growing.** Trampling, trash dumping, and off-road vehicles can severely threaten individual populations. Presently, the one protected site for this species is threatened by trash dumping and off-road vehicle use. This property may require fencing or other protection to eliminate this threat.

- 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.
- H2.1. Restore natural fire regime.** Long periods without fire can change the species composition and the ability of the site to carry fire. 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.
- H2.2. 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 *D. christmanii* 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 *D. christmanii* 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.

