

Aplectrum hyemale

Puttyroot

Orchidaceae



Aplectrum hyemale by Lee Minicucci 2019

***Aplectrum hyemale* Rare Plant Profile**

New Jersey Department of Environmental Protection
Division of Parks and Forestry
New Jersey Forest Service
Office of Natural Lands Management
New Jersey Natural Heritage Program

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Introduction

Orchids comprise ten percent of the world's plant population meanwhile 50 percent of the orchids native to North America are either threatened or endangered in some portion of their range (Smithsonian Environmental Research Center 2019). *Aplectrum hyemale*, commonly known as Puttyroot or Adam and Eve Orchid is one such orchid, currently listed as "Endangered" in the state of New Jersey (New Jersey Natural Heritage Program [hereafter, "NJNHP"] 2010). The two very different common names of the orchid are both in reference to the corm, which is really a pair of corms, the smaller one an offspring of the original (i.e., Adam's Rib). The mucilaginous (or putty-like) substance produced by the corms when crushed was historically used to repair broken pottery (Richburg 2004). While at one point in time the digging up of *Aplectrum* to fix a crack in a favorite mug may have added to its rarity in our state, today a number of factors that are likely contributing to the species' decline will be addressed in this profile, in the hopes of creating a comprehensive conservation effort for this species and the many others listed as endangered in New Jersey.



Aplectrum hyemale illus. by J.A. Torrey
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Corms by Gerrit Davidse (CC BY-NC-SA 3.0)



Puttyroot by cotinis (CC BY-NC-SA 2.0)



Adam and Eve Orchid (P2) by dbarronoss (CC BY-NC-ND 2.0)

Life History

Aplectrum hyemale is a terrestrial North American orchid whose growth and survival are dependent upon the availability of light from fall to spring. During this time, it produces from underground corms, a single leaf that persists at low photosynthetic levels throughout the deciduous forest's normally dormant season (Adams 1970; Auclair 1972). The leaf can grow up to 8 inches in length and up to 3 inches in width. It is dark green with fine, white, parallel veins and a distinctly wrinkled appearance (Illinois Wildflowers 2019). A non-photosynthetic flowering shoot with 3 to 20 small purplish-red & yellowish-green inflorescences is produced in May or early June throughout most of its range; usually after the leaf has begun to wither (Adams 1970; Case 1964).

According to the NJNHP (2019) known colonies in the state can range in size from 3 to 60 leaves yet only a few flower spikes occur per colony in any season. The low chance of flower production and the springtime decay of the characteristic leaf "renders it uncommonly difficult to detect. It is easiest to locate in late autumn, or during a snowless period in late winter, when the solitary, wrinkled green leaves are more conspicuous in contrast to the dead leaves of the forest floor" (Case 1964). Adding to the list of factors contributing to the rarity of *Aplectrum* is the species' clonal reproduction habit and its resultant low genetic diversity (North American Orchid Conservation Center [hereafter, "NAOCC"] 2019).

Pollinator Dynamics

The non-fragrant flower of *A. hyemale* produces no nectar and offers little reward to potential pollinators. While it has been found to have the ability to be autogamous, the self-pollination process of Puttyroot can be inadvertently aided by visitors like the Sweat Bee (*Lasioglossum oblongum*) (Illinois Wildflowers 2019). In the attempts to find any sort of nectar, insects will disturb the pollen cover, freeing it to fall upon the stigma. Self-pollination leads to limited genetic variability (NAOCC 2019).

Seed Dispersal

Ridged, ellipsoid seed capsules up to 1 inch in length form on the stalk after the self-fertilized flowers of *Aplectrum* die back. The capsules which point downward, dry and split open, releasing "abundant" amounts of anemochorous (wind-dispersed) seed (Illinois Wildflowers 2019).

Habitat

Throughout its range, *Aplectrum hyemale* grows in rich deciduous forests often associated with spicebush (Case 1964), sugar maples, and beeches (NAOCC 2019) in mostly mesic woodlands (Richburg 2004). It is "particular to the edges of craters left by uprooted primeval trees where it thrives in deep pockets of humus, often found growing on the periphery of well decayed piles of

logs, sites akin to vernal pools" (Case 1964), and lower slopes of moist ravines (Richburg 2004). In New Jersey, *Aplectrum hyemale* is said to occur on "moist, rich wooded slopes" (Walz et al. 2018). The NJ Natural Heritage Biotics database (2019) lists six known extant Puttyroot occurrences in the state, in habitats ranging from "loamy wooded slopes along [a] streamlet" to limestone woodlands both on ridges and in ravines, all the way to "rich, moist to dry soil near [the] summit of a very rocky diabase hill top". The forest types are not limited to strictly deciduous as one occurrence was detected in a hemlock-birch forest.

In New Jersey, Puttyroot has been found in association with a variety of woody and herbaceous species according to element occurrences documented in the NJNHP Biotics database (2019). The hemlock (*Tsuga canadensis*)-birch (*Betula lenta*) forest occurrence in Sussex county also had *Tilia americana* (Basswood), *Polystichum acrostichoides* (Christmas fern), and *Solidago caesia* (Blue-stemmed goldenrod). Further south in Warren county, *Packera obovata* (Roundleaf ragwort), *Polystichum acrostichoides* (Christmas fern), *Arisaema triphyllum ssp. triphyllum* (Jack in the pulpit), *Alliaria petiolata* (Garlic mustard), and assorted woody seedlings were found in an extant occurrence in 2017. An occurrence in the central part of the state in Somerset county included *Quercus alba*. (White oak), *Liriodendron tulipifera* (Tulip poplar), *Tilia americana* (American basswood), *Fagus grandifolia* (American beech), *Carpinus caroliniana* (Musclewood), *Lindera benzoin* (Spicebush), *Cimicifuga racemosa* (Black cohosh), *Arisaema triphyllum* (Jack in the pulpit), *Phegopteris hexagonoptera* (Broad beech fern), *Uvularia perfoliata* (Bellwort), *Sanguinaria canadensis* (Bloodroot), and *Galearis spectabilis* (Showy orchid). Invasive species of note were *Rosa multiflora* (Rosebush species), *Rubus phoenicolasius* (Wineberry), and *Berberis thunbergii* (Japanese barberry).

Aplectrum hyemale depends on mycorrhizal associations for germination (Oliva & Arditi 1984). Like many orchids, *A. hyemale* can associate with an array of soil fungi (Auclair 1972) one specific fungal associate being *Rhizoctonia neottiae* (MacDougal & Dufrenoy 1944). There is evidence that the mycorrhizal associates of *A. hyemale* are shared with those of nearby oaks and maples (Richburg 2004 citation from Rasmussen 1995).

Wetland Indicator Status

Puttyroot is classified as a Facultative (FAC) species in the state of New Jersey (Walz et al. 2018) meaning that the probability of the species occurring in a wetland is equal to it occurring in non-wetlands (USDA NRCS 2019).

USDA Plants Code

APHY (USDA, 2019)

Coefficient of Conservation (Walz et al., 2018)

CoC = 8; Criteria: Native with a narrow range of ecological tolerances and typically associated with a stable community (Faber-Langendoen 2018).

Distribution and Range

The map below (Figure 1) shows a general view of the range & state rarity status of *A. hyemale*.

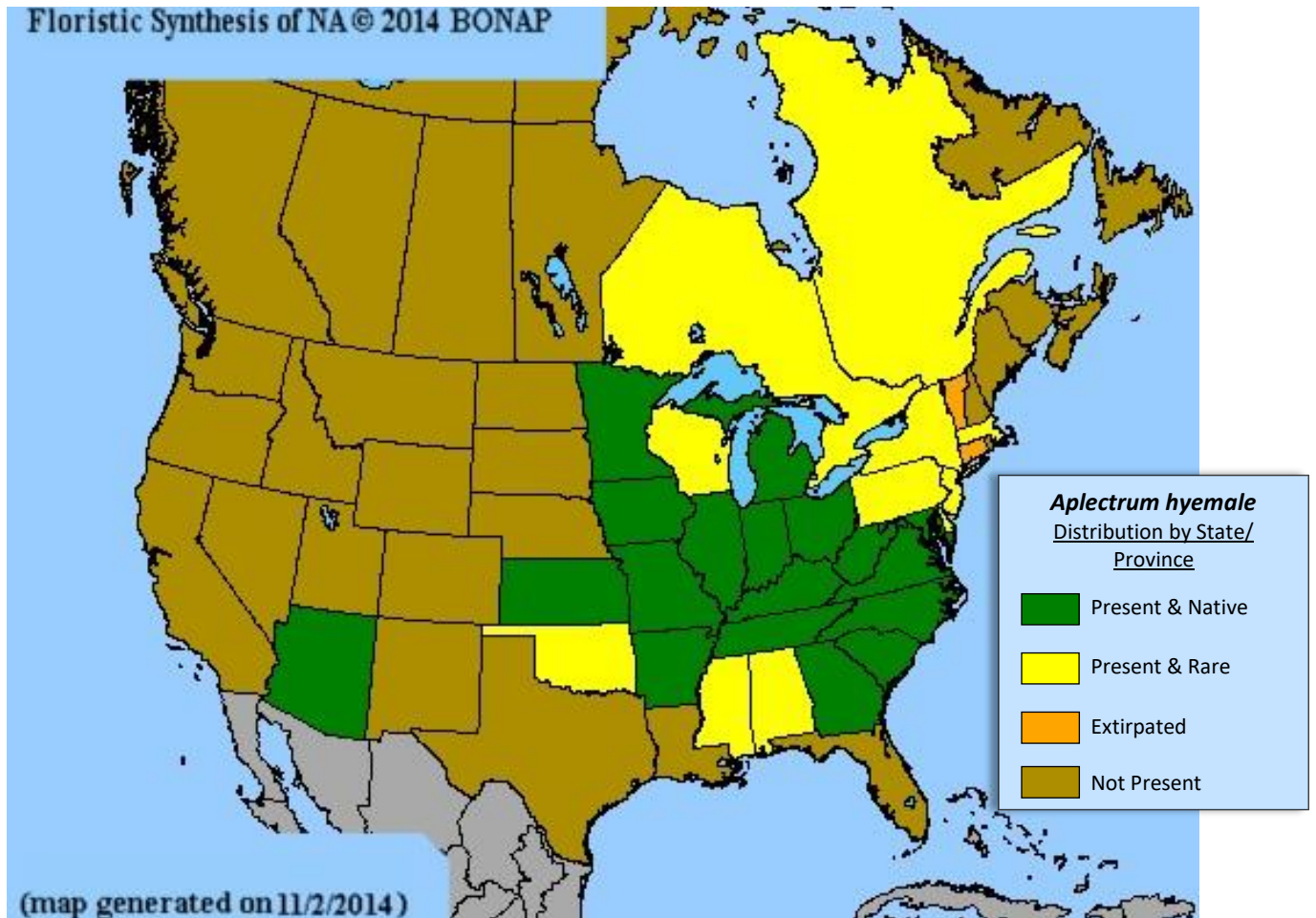


Figure 1: North American State Distribution of Puttyroot; adapted from BONAP (2015).

Below (Figure 2), is a county level distribution map focusing on New Jersey and contiguous counties of the surrounding states. This map is compiled from herbarium data and state literature and many occurrences are now historic. A closer look at the current NJ county level distribution and rarity status of the species as documented in the Biotics database will be discussed in the following section on "Conservation Status".

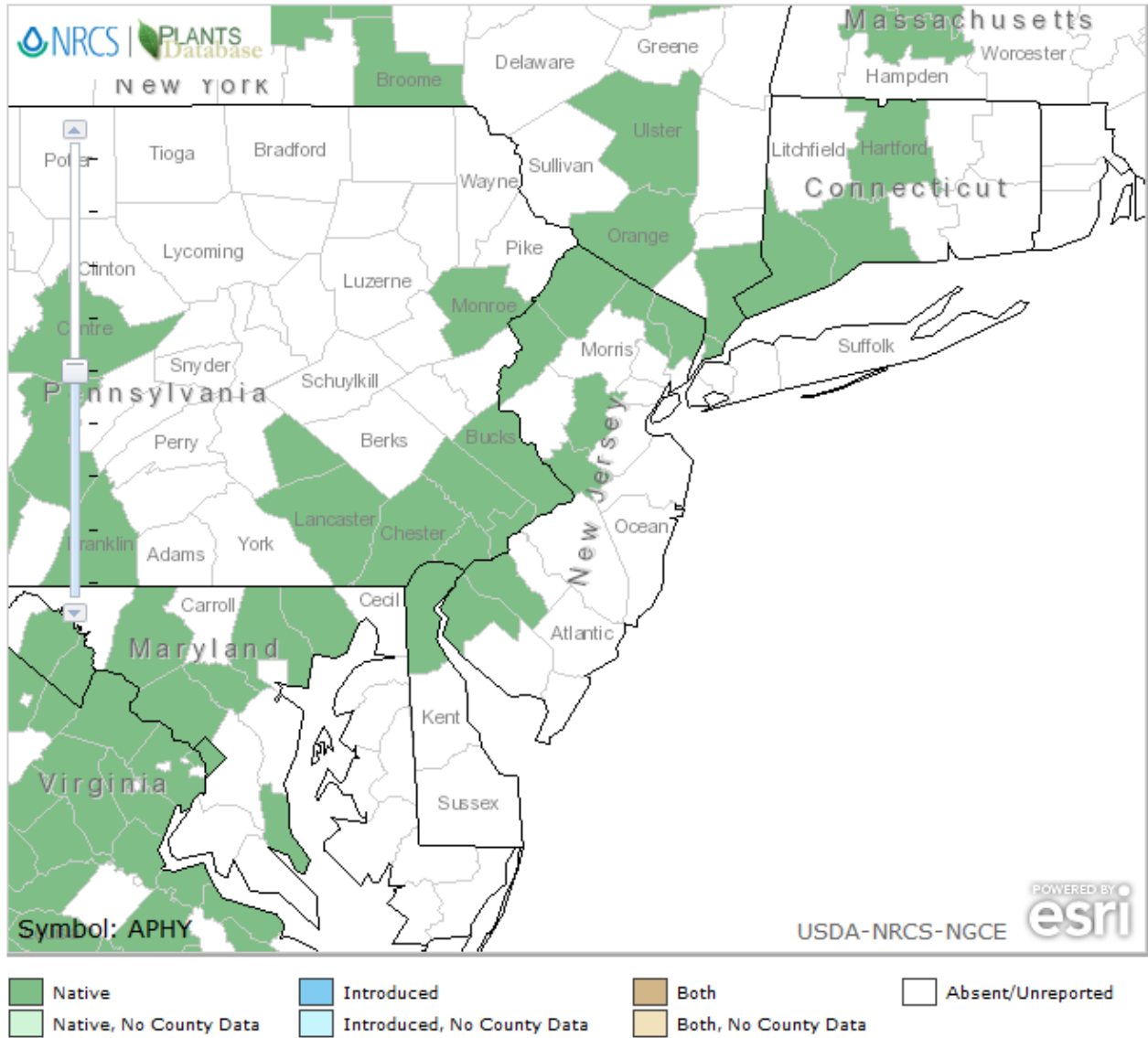


Figure 2: NJ County Distribution of *A. hyemale* adapted from USDA NRCS Plants Database (2019). Note: NJ State Botanist (D. Snyder, June 2019, personal communication) indicates that there are no records in Sussex County (distribution map includes an error).

Conservation Status

The map below (Figure 3) from NatureServe Explorer (2018) illustrates a synthesis of data from individual natural heritage programs regarding their state's conservation rank and status.

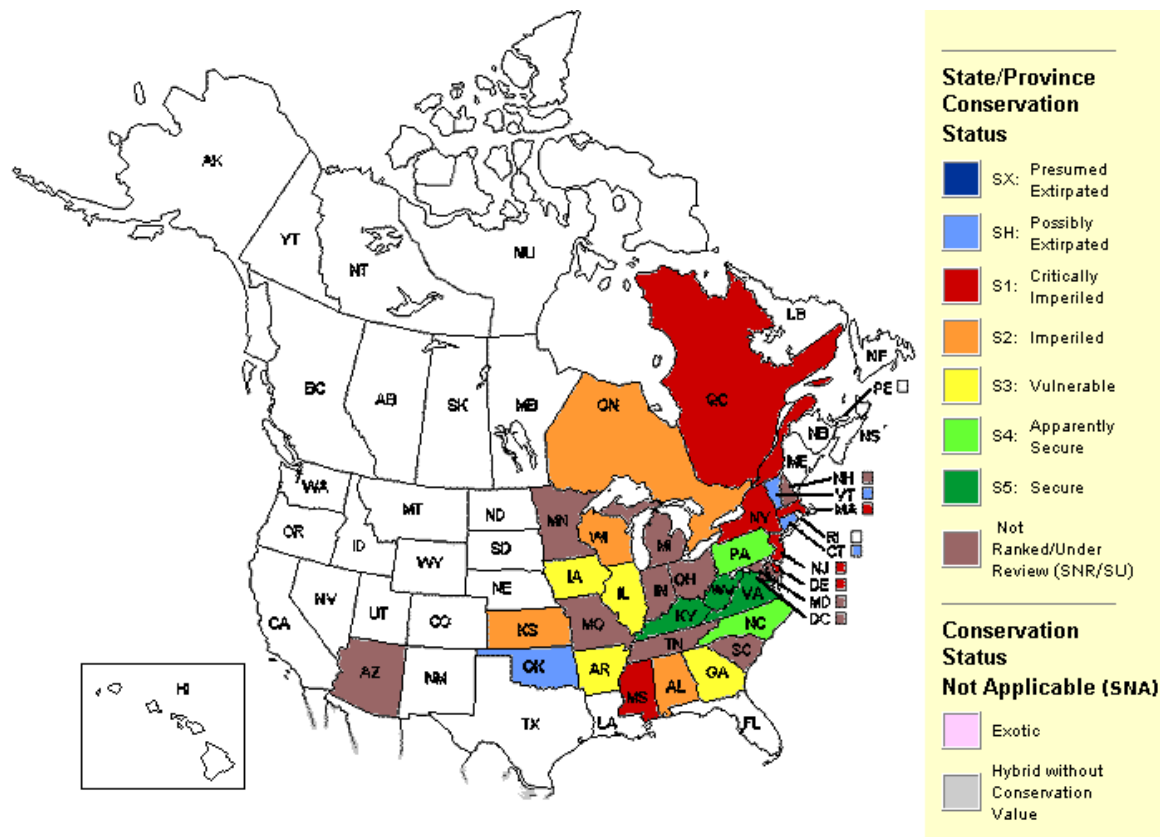


Figure 3: Conservation Status of *A. hyemale*.

Aplectrum hyemale is considered globally stable (G5) meaning that worldwide, the species is "secure: common; widespread and abundant" (NatureServe 2018) but is critically imperiled in many states throughout its range. Puttyroot is considered endangered (E) in New Jersey and according to the state's Natural Heritage Program, that status indicates a "Native New Jersey plant species whose survival in the State or nation is in jeopardy". The state rank of S1, in accordance to the Nature Conservancy element ranks used by the NJNHP (2010) defines the species as "Critically imperiled in New Jersey because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres). Elements so ranked are often restricted to very specialized conditions or habitats and/or restricted to an extremely small geographical area of the state. Also included are elements which were formerly more abundant, but because of habitat destruction or some other critical factor of its biology, they have been demonstrably reduced in abundance. In essence, these are elements for which, even with intensive searching, sizable additional occurrences are unlikely to be discovered."

The other status codes indicate that the species is "HL" or "protected by the Highlands Water Protection and Planning Act within the jurisdiction of the Highlands Preservation Area" and "LP" meaning that the "taxa [is] listed by the Pinelands Commission as endangered or threatened within their legal jurisdiction. Not all species currently tracked by the Pinelands Commission are tracked by the Natural Heritage Program. A complete list of endangered and threatened Pineland species is included in the New Jersey Pinelands Comprehensive Management Plan" (NJNHP 2010).

There are 13 known sites from NJ, according to the NJ Natural Heritage Program Biotics 5 Database (2019), composed of 4 historical G-precision, 3 historical M-precision, and 6 extant S-precision occurrences. However, 3 of the 6 extant occurrences have not been updated or revisited in over 25 years, including NJ's largest occurrence.

Threats

Aplectrum hyemale responds negatively to disturbance. Man-made disturbances to old growth forests can sometimes change the habitat from mesic to one of xeric (dry and nutrient poor) conditions. This change often allows for the invasion of pioneer species that possess more adaptive reproductive strategies than niche species like Puttyroot (Auclair 1972). In the state of Illinois for example, invasive species *Alliaria petiolata* (Garlic mustard) and *Lonicera japonica* (Japanese honeysuckle) are known to have detrimental effects on extant populations of the orchid (Illinois Wildflowers 2019). A fact sheet released by the Rutgers University Cooperative Extension's NJ Agricultural Experimental Station (Sabin and Polanin 2019) on the negative ecological impacts of Garlic mustard found the plant to be allelopathic: producing chemicals that inhibit native plant growth and possibly hinder the formation of mycorrhizal fungi (the association necessary for *A. hyemale* to grow and survive).

Throughout New England, according to Richburg (2004) disturbances such as land development and direct habitat destruction are not the issue; as "at least three out of five known occurrences are on protected land. The taxon is more immediately threatened by a multitude of events that could negatively impact one or more individuals in extremely small populations. These populations could be irreparably damaged by any small stochastic event or by changes to their habitat (such as an increase in evergreen cover or a decrease in moisture) due to climate change, acid rain, or invasive species."

Richburg does point out that in less protected areas, activities such as "off-road vehicle use, timber harvesting, and even hiking, may also negatively impact individuals or entire populations of this species." The New York Natural Heritage Program (2019) states that (like New England) most populations of *Aplectrum* occur in protected areas and broadly lists "acid rain deposition, changes in soil chemistry, changes in the composition of soil fungal species, and deer herbivory" as possible threats. The removal of trees through planned forestry management activities on protected land could potentially disrupt the mycorrhizal hyphal network that allows for the symbiosis necessary for the orchids to persist.

Management Summary and Recommendations

"Because orchids are often viewed as indicators of overall environmental health, understanding the biology and ecology of orchids, fungi and pollinators, as well as their ecosystem requirements, is necessary to develop effective protocols for orchid preservation and propagation" (Smithsonian Environmental Research Center 2019). There is little to no information on the impact to endangered or imperiled upland or facultative plant species like Puttyroot from disturbances, including disturbance from any type of forestry activities.

Richburg (2004) suggests that further studies on the biology of Puttyroot be conducted in states with secure and abundant populations of the species. Studies to help establish necessary buffer zones around *Aplectrum* are recommended for incorporation into forest management proposals. Such studies could quantify the effects on population size, flowering numbers, and fungal associates in response to the various timber harvesting methods.

If habitat is found to be impacted by invasive species, there are many species-specific plans in the state repertoire that address the control of such infestations. The NJDEP (2019) has fact sheets with options for different methods of control for both Garlic mustard and Japanese honeysuckle that are available online and the NJ Department of Agriculture (Mayer et al. 2011) provides a comprehensive report on ongoing biological control experiments for *Alliaria petiolata*. While there are no state studies that currently evaluate the effects on *Aplectrum hyemale* itself when managing aggressive non-native competitors, evidence from experimental trials found that overall "the removal of garlic mustard led to increased diversity of annuals, tree seedlings and other plant species" (Sabin and Polanin 2019).

The survival of *A. hyemale* relies on stable environmental conditions (Auclair 1972). The New York Natural Heritage Program (2019) suggests that a large undisturbed buffer be maintained around occurrences of this orchid followed by regular monitoring. While some threats to environmental stability like climate change cannot be managed at the local level, others like creating hiking trail diversions and deer exclosures, and posting signs indicating the presence of a sensitive species can be easily implemented. Until further research is conducted to better understand the biology of the species, it is advisable that any wooded area in the state of New Jersey containing occurrences of *Aplectrum hyemale* be left out of forestry management plans and protected due to the delicate nature of the orchid within its immediate ecosystem.

Synonyms

Currently there are no accepted synonyms for the species *Aplectrum hyemale*.

Botanical Name

Aplectrum hyemale (Muhl. ex Willd.) Torr

Common Names

Puttyroot
Adam and Eve Orchid

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