

Pycnanthemum clinopodioides

Basil Mountain-mint

Lamiaceae



Pycnanthemum clinopodioides Courtesy Stephanie Brundage, Lady Bird Johnson Wildflower Center

***Pycnanthemum clinopodioides* Rare Plant Profile**

New Jersey Department of Environmental Protection
State Parks, Forests & Historic Sites
Forests & Natural Lands
Office of Natural Lands Management
New Jersey Natural Heritage Program

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Life History

Pycnanthemum clinopodioides (Basil Mountain-mint) is a rhizomatous perennial herb in the Lamiaceae. The plants can reach a meter in height, but a detailed study of a New Jersey population recorded an average height of about 58 cm (NJNHP 2024). The stems are four-sided and downy, with a mixture of straight long hairs and shorter, strongly curving hairs. Pairs of leafy branches are usually present along the stem. The leaves of *P. clinopodioides* may be sharply toothed or nearly entire; green on both sides or whitish above; they are consistently lance-shaped but their width can range from 10–25 mm. When crushed, the leaves emit a pungent minty fragrance that is characteristic of the genus (Sørensen and Matekaitis 1981, Dein 2019). The small flowers are arranged in dense clusters that form hemispheric heads. The calyx lobes are unequal in length (range 0.7–1.6 mm) and bristle-tipped. *P. clinopodioides* corollas are distinctly two-lipped, and they are typically white with purple spots. When fruiting, each flower produces four single-seeded nutlets. (See Gray 1842, Britton and Brown 1913, Fernald 1950, Gleason and Cronquist 1991, Snyder 1994, Rhoads and Block 2007, Weakley et al. 2022).



Left: Britton and Brown 1913, courtesy USDA NRCS 2024a. Right: Devin Floyd, 2020.

Care must be taken with the identification of mountain-mints. Eight *Pycnanthemum* species occur in New Jersey (Kartesz 2015) and *P. clinopodioides* can sometimes be found growing with several other members of the genus (Chambers 1961, NJNHP 2024). *Pycnanthemum* has long been viewed as a difficult taxon. In recounting the details of a recent botanical expedition, Gray (1842) observed that while attempting to identify various mountain-mints that had been collected "we encountered so many difficulties that I am induced to give a revision of the whole genus," (which he then proceeded to do in a footnote to the trip report). About a century later Grant and Epling (1943) examined the genus and noted a great deal of morphological overlap, eventually sorting most of the species into what they characterized as two poorly defined groups with *P. clinopodioides* falling somewhere in the middle. The challenges presented by the genus are

attributable to frequent hybridization and a high rate of polyploidy. *Pycnanthemum clinopodioides* is a tetraploid species ($2n = 76$) and it has been known to hybridize with a number of other mountain-mints in natural and experimental settings (Chambers 1961, Chambers and Chambers 1971). A recent treatment of *Pycnanthemum* by Chambers and Chambers (2008) established seven sections and placed *P. clinopodioides* in Section *Pycnanthemum*. The only other species in that group which occurs in New Jersey is *P. incanum*. The leaves of *P. incanum* are typically much broader than those of *P. clinopodioides* and they are also pubescent below while the undersides of *P. clinopodioides* leaves are smooth (Snyder 1994, Rhoads and Block 2007, Weakley et al. 2022).

Pycnanthemum clinopodioides can bloom from July to September (Gray 1842, Hough 1983, Weakley et al. 2022). Plants seen in New York by members of the Torrey Botanical Society (2000) were not yet flowering on June 20, 1999. Sorrie (1987) observed that *P. clinopodioides* plants in Massachusetts were in full bloom when *P. incanum* was just beginning to flower and *P. tenuifolium* had finished. A typical population of *P. clinopodioides* includes both flowering and nonflowering plants. A survey of one New Jersey occurrence found that 82% of the plants were in bloom and had produced an average of 6.5 inflorescences per flowering plant, but notes on another occurrence indicated that the majority of the population had not flowered (NJNHP 2024). Fruits are likely to be present well into November (NYNHP 2005). *Pycnanthemum* stems usually remain standing throughout the winter (Levine 1995) and sometimes *P. clinopodioides* fruits can still be found the following spring (NJNHP 2024).

Pollinator Dynamics

Pycnanthemum plants generally remain in bloom for weeks and the flowers are highly attractive to many insects. The genus was identified as an important food source for native bees by Wilson and Carril (2016). A wide variety of long- and short-tongued bees, wasps, flies, butterflies, moths, and beetles have been documented on mountain-mint blooms (Robertson 1929, Stubbs et al. 1992, Pant and Mopper 2021, Swiantek 2023). Holm (2014) noted that medium to large bees are particularly effective pollinators because they are more likely to come into contact with the reproductive parts in the upper lips of the flowers while foraging.

Pycnanthemum stamens develop first and have finished shedding their pollen by the time the stigmas become receptive so individual flowers are not self-fertilized (Chambers and Chambers 1971). However, most species—including *P. clinopodioides*—are self-compatible and viable seeds can result from the transfer of pollen between flowers on the same head (Chambers 1961).

Seed Dispersal

Pycnanthemum nutlets have no special adaptations for distribution and the propagules of most species are passively dispersed by gravity and thus remain close to the parent plants (Brudvig and Mabry 2008, Myers 2010, Tessel 2017). Potential mechanisms for the long-distance dispersal of *P. clinopodioides* seeds have not been identified. The nutlets of many species in Lamiaceae (subfamily Nepetoideae) become sticky when moistened, which could facilitate

dispersal by adherence to fur or feathers, although tests of various genera in the group have indicated that mucilage production is usually absent in *Pycnanthemum* (Ryding 1992, Moon et al. 2009). Nevertheless the small seeds might sometimes be dispersed over longer distances by animals: For example, Eyheralde (2015) observed that seeds of *P. virginianum* were occasionally transported in bison hair, and Holder (2023) noted that *P. incanum* seeds can be an important food source for birds late in the year when insect availability is limited.

It is possible that the seeds of *Pycnanthemum clinopodioides* need a period of cold stratification in order to germinate. Deno (1993) reported that seeds of *P. incanum* which were placed outdoors in November germinated during April. *Pycnanthemum* seeds require light for germination: They do best when sown on the surface and kept continually moist (Tallgrass Prairie Center 2015). Results from studies of other *Pycnanthemum* species suggest that germination and establishment of *P. clinopodioides* seeds could be affected by the composition of local fungal and vegetative communities. The formation of arbuscular mycorrhizae has been documented in related species like *P. tenuifolium* and *P. virginianum* (Cooke 1994, Turner et al. 2000) although it is not clear if fungal associations are required for seedling establishment. Miller et al. (2019) found that germination in *P. tenuifolium* was reduced at sites where the soil communities had been conditioned by the presence of *Ageratina altissima* or *Bromus inermis*.

Habitat

Pycnanthemum clinopodioides often grows on wooded slopes where the ground is dry and rocky (Britton 1889, Hitchcock and Standley 1919, Coddington and Field 1978, Hough 1983, Torrey Botanical Society 2000, Lamont and Fitzgerald 2001, NYNHP 2005, Rhoads and Block 2007, NJNHP 2024). The bedrock may consist of an igneous or sedimentary material but often has a relatively high pH (Snyder 1994, NYNHP 2005, NJNHP 2024). Nichols et al. (2018) noted that *P. clinopodioides* has also been documented in circumneutral outcrop communities.

Habitats noted by Weakley et al. (2022) include forests, woodlands, and woodland borders; Latham (2003) also included upland shrub thickets on a list of habitats where *P. clinopodioides* could occur. When Basil Mountain-mint grows in forested areas the sites are often described as open or lightly wooded (Sorrie 1987, NYNHP 2005), and Fernald (1937) found Virginia plants on a woodland border and in adjacent clearings. New Jersey populations have often been associated with naturally occurring limestone or traprock glades or comparable habitat in areas that have been deliberately cleared (Snyder 1994, NJNHP 2024). A recent study of *Pycnanthemum verticillatum* var. *verticillatum* determined that established plants can survive in shaded locations but more vigorous growth and reproduction occurs in full or partial sunlight (Carden et al. 2024).

Pycnanthemum clinopodioides frequently grows with other members of the genus including *P. incanum*, *P. tenuifolium*, and *P. torreyi*. *P. clinopodioides* can also share the habitat with an assortment of graminoids such as *Carex pennsylvanica*, *Anthoxanthum* sp., *Danthonia spicata*, *Dichanthelium* spp., *Muhlenbergia sobolifera*, or *Schizachyrium scoparium*. Additional herbaceous associates may include *Eupatorium sessilifolium*, *Euthamia graminifolia*, *Helianthus*

divaricatus, *Penstemon digitalis*, or *Thalictrum revolutum* (Sorrie 1987, Lamont and Fitzgerald 2001, NJNHP 2024).

Wetland Indicator Status

Pycnanthemum clinopodioides is not included on the National Wetlands Plant List (NWPL). Any species not on the NWPL is considered to be Upland (UPL) in all regions where it occurs. The UPL designation means that it almost never occurs in wetlands (U. S. Army Corps of Engineers 2020).

USDA Plants Code (USDA, NRCS 2024b)

PYCL

Coefficient of Conservancy (Walz et al. 2020)

CoC = 8. Criteria for a value of 6 to 8: Native with a narrow range of ecological tolerances and typically associated with a stable community (Faber-Langendoen 2018).

Distribution and Range

The global range of *Pycnanthemum clinopodioides* is restricted to the United States (POWO 2024). The map in Figure 1 depicts the extent of Basil Mountain-mint in North America.

The USDA PLANTS Database (2024b) shows records of *Pycnanthemum clinopodioides* in twelve New Jersey counties: Atlantic, Bergen, Camden, Essex, Gloucester, Hunterdon, Mercer, Middlesex, Morris, Passaic, Sussex, and Warren (Figure 2). The data include historic observations and do not reflect the current distribution of the species.

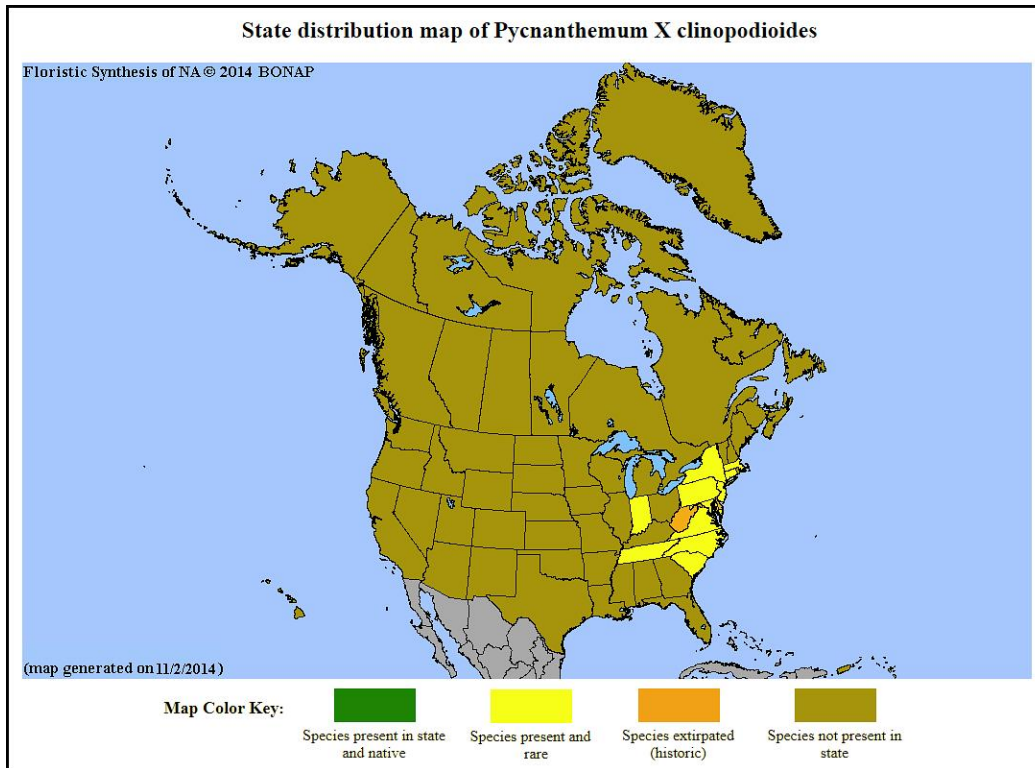


Figure 1. Distribution of *P. clinopodioides* in North America, adapted from BONAP (Kartesz 2015).

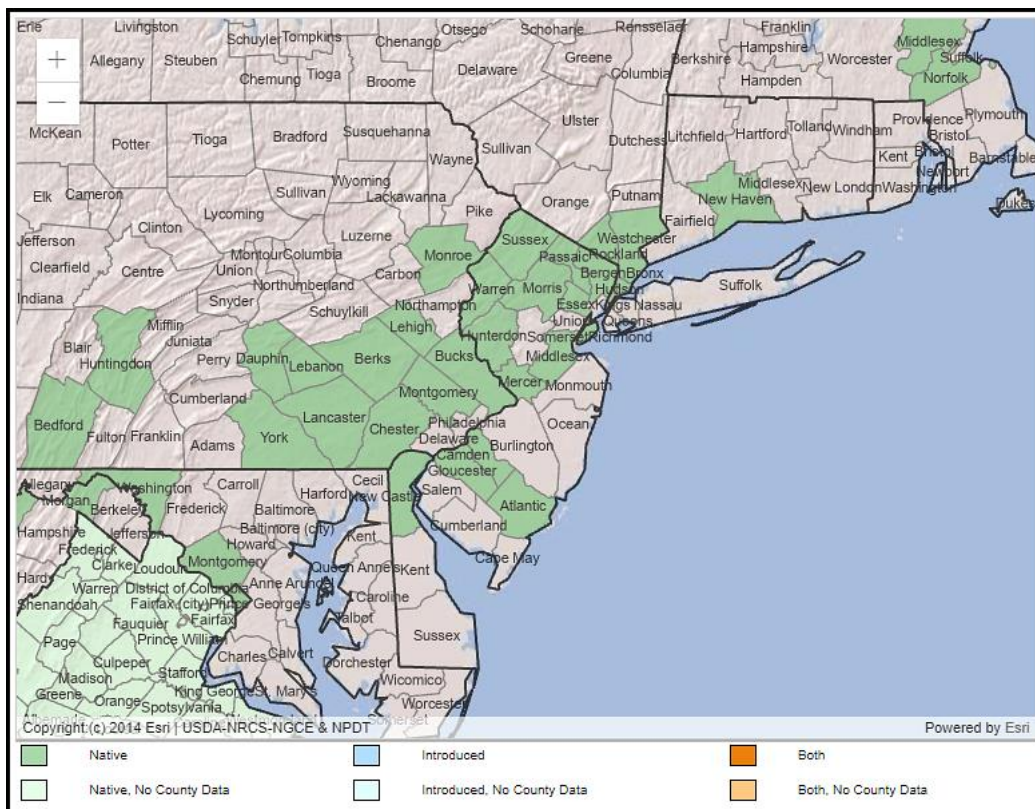


Figure 2. County records of *P. clinopodioides* in New Jersey and vicinity (USDA NRCS 2024b).

Conservation Status

Pycnanthemum clinopodioides has a global rank of G1G2, meaning there is some uncertainty as to whether it should be considered critically imperiled or imperiled worldwide. A G1 species faces a very high risk of extinction or collapse due to a very restricted range, very few populations or occurrences, very steep declines, very severe threats, or other factors. A G2 species faces a similar suite of threats at a slightly lower level of intensity (NatureServe 2024). The map below (Figure 3) illustrates the conservation status of *Pycnanthemum clinopodioides* throughout its confirmed range.

Pycnanthemum clinopodioides is critically imperiled in six states and possibly extirpated in three others. It is presumed extirpated in the District of Columbia. Basil Mountain-mint is present in Connecticut but it is viewed as a hybrid in that state, and it has been reported but not ranked in South Carolina. Recent observations of the species in Kentucky and Tennessee await confirmation but other reports of disjunct occurrences are thought to be unlikely (Russell et al. 2023). *Pycnanthemum clinopodioides* has been identified as a plant species of highest conservation priority for the North Atlantic region, which includes four Canadian provinces and twelve U. S. states. The species has a regional rank of R1 (critically imperiled), signifying a very high risk of extinction (Frances 2017).

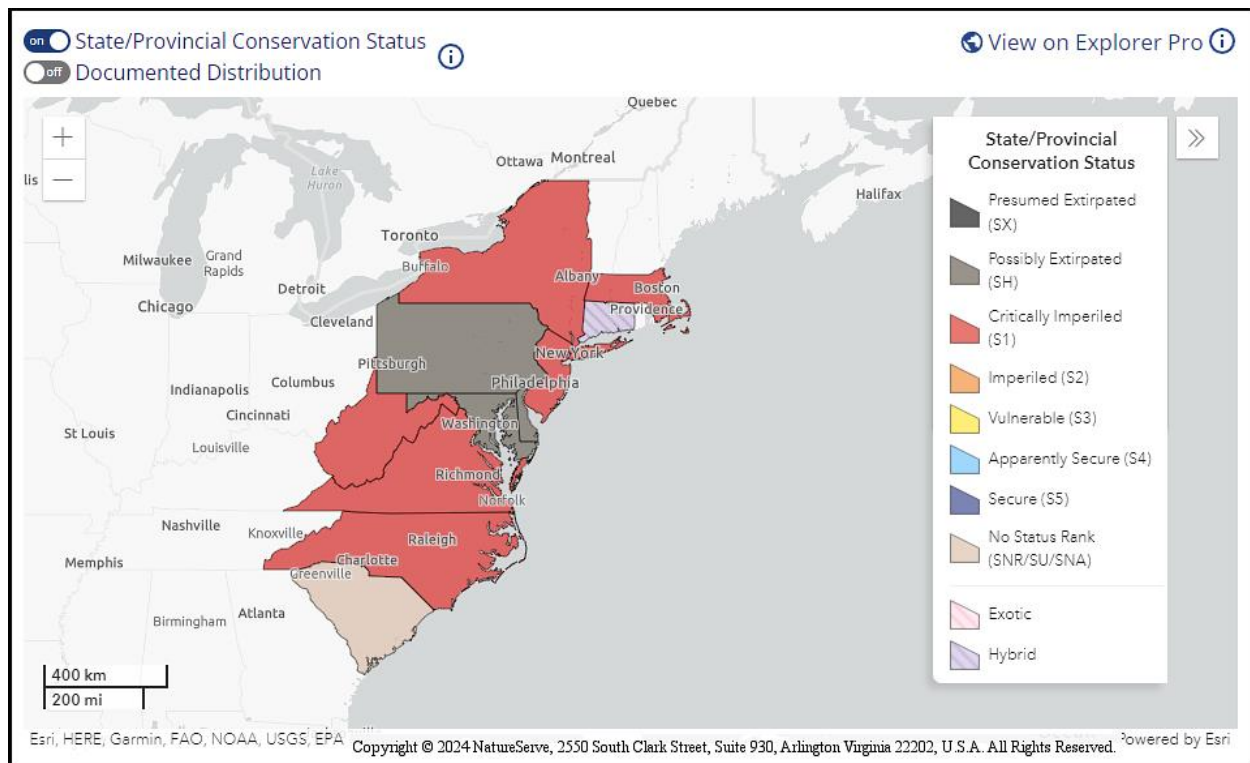


Figure 3. Conservation status of *P. clinopodioides* in North America (NatureServe 2024).

Pycnanthemum clinopodioides is critically imperiled (S1) in New Jersey (NJNHP 2024). The rank signifies five or fewer occurrences in the state. A species with an S1 rank is typically either restricted to specialized habitats, geographically limited to a small area of the state, or significantly reduced in number from its previous status. *P. clinopodioides* is also listed as an

endangered species (E) in New Jersey, meaning that without intervention it has a high likelihood of extinction in the state. Although the presence of endangered flora may restrict development in certain communities, being listed does not currently provide broad statewide protection for plants. Additional regional status codes assigned to *P. clinopodioides* signify that the species is eligible for protection under the jurisdictions of the Highlands Preservation Area (HL) and the New Jersey Pinelands (LP) (NJNHP 2010).

Gray (1842) initially reported that *Pycnanthemum clinopodioides* was present in New Jersey and by the early 1900s there were records of the species from numerous locations around the state (Britton 1889, Keller and Brown 1905, Taylor 1915). The first New Jersey collection of the 20th century was made in 1980 by Snyder (1994, 2000), who subsequently discovered several additional populations in the northern part of the state. Breden et al. (2006) noted that the species was extant in Passaic and Sussex counties, and a new population was later found in Bergen County (NJNHP 2024). Documented occurrences from central and southern New Jersey are currently ranked as historical or extirpated.

Threats

Throughout the known range of *Pycnanthemum clinopodioides* very few populations are thought to have relatively good viability—only five were noted by Russell et al. (2023), who indicated that loss of habitat is the greatest threat facing the species. In some instances losses are directly attributable to development or resource extraction but in other cases habitat suitability for *P. clinopodioides* has declined as a result of changes in plant community composition. Natural succession and increased competition with woody species were identified as the primary concerns for three out of four New Jersey occurrences, and at two of those sites emerging threats from the proliferation of invasive plant species (*Lonicera japonica*, *Persicaria perfoliata*) were also noted (NJNHP 2024). Dodge (1997) documented changes from both successional processes and the spread of non-native species in one New Jersey forest associated with a *P. clinopodioides* occurrence, identifying fire suppression as a possible cause of the community shifts observed at the site. Similar threats have been reported to *P. clinopodioides* populations in New York (NYNHP 2005).

Pycnanthemum clinopodioides plants might be vulnerable to a powdery mildew. An observation of the fungal pathogen *Golovinomyces monardae* growing on *Pycnanthemum incanum* was the first U. S. record of its occurrence on a *Pycnanthemum* species, but further testing demonstrated that other mountain-mints (*P. virginianum*, *P. muticum*) are also susceptible (Klingeman et al. 2018). *G. monardae* typically results in some leaf damage or loss but severe infections can reduce a host plant's growth, vigor, and winter hardiness, and when the fungus develops on floral buds they may develop abnormally or fail to open (Burgess and Williamson 2021).

Herbivory by White-tailed Deer (*Odocoileus virginianus*) was mentioned as a possible threat to *Pycnanthemum clinopodioides* (Russell et al. 2023). Holder (2023) characterized *P. clinopodioides* as highly deer resistant, a claim often made about mountain-mints due to their aromatic foliage. However, deer browse has been documented on various *Pycnanthemum*

species (Atwood 1941, Anderson et al. 2001) and *P. muticum* apparently reestablished at a Tennessee site after herbivores were excluded (Griggs et al. 2006).

Climate Change Vulnerability

Shifting climactic conditions in New Jersey are resulting in higher temperatures, a longer growing season, more frequent and intense precipitation events, and increasing periods of drought (Hill et al. 2020). An attempt was made to assign *Pycnanthemum clinopodioides* a rank from NatureServe's Climate Change Vulnerability Index using the associated tool (Version 3.02) to estimate its exposure, sensitivity, and adaptive capacity to changing climactic conditions in accordance with the guidelines described by Young et al. (2016). However, there was not sufficient information available regarding Basil Mountain-mint for a meaningful assessment of the species' vulnerability in New Jersey. Specific data is lacking regarding its long-distance dispersal mechanisms, seed-banking potential, germination and establishment requirements, susceptibility to pathogens, adaptability to seasonal shifts in temperature patterns, and drought tolerance.

Invasive plants, which are often identified as threatening to *P. clinopodioides* populations, are likely to become an even greater challenge in New Jersey as the climate continues to warm. The northeastern and mid-Atlantic regions are predicted to become hotspots for the establishment of introduced species, many of which are expected to have a significant impact on native plant communities (Bellard et al. 2013, Salva and Bradley 2023). Other evaluations have projected that a number of the nonnative species which have already gained a foothold in the northeast are likely to become more abundant (Dukes et al. 2009, Coville et al. 2021, O'Uhuru 2022).

Management Summary and Recommendations

Available information suggests that New Jersey's extant populations of *Pycnanthemum clinopodioides* could benefit from habitat management with a focus on the maintenance of a relatively open canopy. At some locations, invasive species control would likely help the mountain-mint to persist. Planned burning might be a useful tool for managing the structure of communities inhabited by *P. clinopodioides*, as fire suppression has sometimes been identified as contributing to the problem (eg. Dodge 1997, NYNHP 2005). However the effects of fire on *P. clinopodioides* have not been studied and more information is needed regarding the appropriate intensity, frequency, and timing of burns before the technique can be recommended.

In addition to studies of fire effects, research is necessary to fill some of the gaps in knowledge about *P. clinopodioides* identified in previous sections. For example, basic life history information is needed so that land can be managed in ways that promote vigorous growth or create suitable sites for seedling establishment, and an understanding of the actual impact of deer browse on the species would help to determine whether an investment in herbivore exclusion is warranted.

The global rarity of *Pycnanthemum clinopodioides* makes it particularly important to have a handle on the status of the species throughout its range, and searches of both historical locations and potential habitat were recommended by Russell et al. (2023). Basil mountain-mint was once thought to be extirpated in New York but it was rediscovered after not being seen for more than a century (Young 1999, NYNHP 2005), so there is a chance that diligent searching could turn up additional populations in New Jersey.

Synonyms

The accepted botanical name of the species is *Pycnanthemum clinopodioides* Torr. & A. Gray. Orthographic variants, synonyms, and common names are listed below (ITIS 2024, POWO 2024, USDA NRCS 2024b). Gray's 1842 footnote appears to be the first published description of *P. clinopodioides*, although he cited the authorship as "*Torr. & Gray, fl. N. Amer. ined.*" John Torrey and Asa Gray were at that time collaborating on a new North American flora, and although several volumes were printed the project was never completed and the section that included *Pycnanthemum* did not make it into publication (Flannery 2017).

Botanical Synonyms

Koellia clinopodioides (Torr. & A. Gray) Kuntze

Common Names

Basil Mountain-mint

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