Pycnanthemum torreyi

Torrey's Mountain-mint

Lamiaceae

Pycnanthemum torreyi by Nelson DeBarros, 2019

***Pycnanthemum torreyi* Rare Plant Profile**

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

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Life History

Pycnanthemum torreyi (Torrey's Mountain-mint) is a rhizomatous perennial herb in the Lamiaceae. The squarish stems are simply branched and can reach up to a meter in height, and the stem pubescence is evenly distributed. Both branches and leaves are in pairs along the stems. The thin leaves are 3–6 cm long and 5–12 mm wide: They are narrowly lance-shaped, tapering to short petioles at their bases, and have a few small teeth. As in other mountain-mints, the leaves of *P. torreyi* are aromatic when crushed. The flowers are arranged in dense clusters at the ends of the branches. The corollas are white and two-lipped, culminating in three lobes on the purple-spotted lower lip. The sepals are 1.0–1.5 mm long and end in sharp points, and the four stamens are as long as the flower's upper lip. The petals and sepals are softly hairy. In fruit, each flower produces four single-seeded nutlets. (Bentham 1834, Fernald 1899, Fernald 1950, Hodgdon and Steele 1972, Gleason and Cronquist 1991, Reid et al. 2021, Weakley et al. 2022). Torrey's Mountain-mint may bloom and fruit from June to October (Weakley et al. 2022). In New Jersey, most observations of the plants in flower have occurred during the summer (NJNHP 2022).

Bissell 1910, courtesy Steere Herbarium.


Nelson DeBarros, 2019.

Pycnanthemum torreyi could be confused with several other narrow-leaved mountain-mints that occur in New Jersey such as *P. tenuifolium*, *P. virginianum*, or *P. verticillatum*. The leaves of *P. tenuifolium* are linear and only 2–3 mm wide and those of *P. virginianum* are rounded at the base and stalkless. *Pycnanthemum torreyi* is most similar to *P. verticillatum*, and in the past a number of botanists have merged the two species (Britton and Brown 1913, Taylor 1915, Hough 1983).

The long, sharp sepal-tips are the most reliable way to recognize *P. torreyi*—the sepals of *P. verticillatum* and *P. virginianum* are not sharp-tipped (Hodgdon and Steele 1972, Snyder 1994, Rhoads and Block 2007).

Pycnanthemum torreyi is a polyploid species for which both tetraploid and hexaploid populations have been documented (Chambers 1961, Chambers and Hamer 1992). Hybridization and polyploidy are frequent within the genus (Chambers 1993). Chambers and Chambers (2008) proposed an updated division of *Pycnanthemum* into seven sections, each of which is aligned with one (or occasionally more) diploid species. The authors placed *P. torreyi* in section Capitellatae, and the core diploid species that unifies the group is *P. tenuifolium*. There is some DNA evidence that *Pycnanthemum torreyi* has a hybrid origin with another "parent" species outside of the Capitellatae, perhaps *P. muticum*, but further study is needed.

Pollinator Dynamics

Some of the *Pycnanthemum* species that are closely related to *P. torreyi* are able to form viable seeds without being fertilized (apomictic). Both *P. tenuifolium* and *P. muticum* sometimes develop flowers that lack functional anthers and *P. verticillatum* nearly always does (Chambers 1961). However, the specimens of *P. torreyi* examined by Chambers (1961) had well-developed anthers that produced abundant pollen. In sexual *Pycnanthemum* plants the stamens develop first and have finished shedding their pollen by the time the stigmas become receptive so individual flowers are not self-fertilized. Nevertheless, some self-pollination can occur between flowers on the same head (Chambers and Chambers 1971).

Cross-fertilization is carried out by insects. Studies of pollinator preferences often find that *Pycnanthemum* species have higher visitation rates than most plants in the Lamiaceae and in other families (Russo et al. 2013, MacLeod et al. 2019, Kahlil 2021). *Pycnanthemum* flowers are often cited as important sources of pollen and nectar for bees (Wratten et al. 2012): Stubbs et al. (1992) listed 15 bee species known to visit *Pycnanthemum* blooms and Mathews and Collins (2014) retrieved *P. montanum* pollen from bumblebees, honeybees, and sweat bees. In general, *Pycnanthemum* species are visited by a wide variety of bees, wasps and flies as well as some butterflies, skippers, moths and assorted other insects (Hilty 2020). During a recent study, *P. muticum* flowers were visited by more taxa than those of any other plants but only around 10% of the visitors were bees and the vast majority were non-bee species (Pant and Mopper 2021). Although *P. torreyi* has not been included in pollinator studies it almost certainly attracts a broad array of insects, and photos of its flowers being visited by bees, beetles, and butterflies can be found on the internet (eg. Dogtooth77 2014, Center for Urban Habitats 2020, Adamovic 2022).

Seed Dispersal

Pycnanthemum nutlets have no special adaptations for distribution and the propagules of most species are passively dispersed via gravity (Brudvig and Mabry 2008, Myers 2010, Tessel 2017). While *Pycnanthemum torreyi* stems are still standing the seeds may be retained in the capsules until they are dislodged by wind or a passing animal, and as the stems disintegrate the remaining

seeds are likely to be deposited near the parent plants (Hill 2007, Block and Rhoads 2103). 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.

It is likely that the seeds of *Pycnanthemum torreyi* 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, and cultivation instructions for other *Pycnanthemum* species have also noted the requirement for a period of cold, dry storage prior to sowing (Prairie Moon Nursery 2015). Additional guidelines from the nursery indicated that germination of *Pycnanthemum* seeds is promoted by light, moisture, and warm temperatures.

Results from studies of other *Pycnanthemum* species suggest that germination and establishment of *P. torreyi* seeds might be affected by the composition of local fungal and vegetative communities. The formation of arbuscular mycorrhizae has been documented in closely related species like *P. tenuifolium* and *P. virginianum* (Cooke 1994, Turner et al. 2000) although it is not clear whether or not fungal relationships 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 torreyi grows in dry, rocky places over mafic or calcareous substrates (Klotz and Walck 1993, Snyder 1994, Townsend and Ludwig 2020, Weakley et al. 2022). Reported habitats include woodlands, thickets, prairies, grasslands and meadows (Bissell 1911, Hodgdon and Steele 1972, Klotz and Walck 1993, Lamont and Fitzgerald 2001, Rhoads and Block 2007, Gregg and Klotz 2015, Weakley et al. 2022). Typical locations where *P. torreyi* has been found have been described as barrens, escarpments, glades, outcrops, rocky slopes, and summits (Hodgdon and Steele 1972, Snyder 1994, Lamont and Fitzgerald 2001, Schimp 2005, Rajakaruna et al. 2009, NYNHP 2023). Fernald (1941) described one Virginia occurrence as "our first coastal plain station for an upland species."

There is some anecdotal evidence that *Pycnanthemum torreyi* prefers sites with intermediate light levels such as sun-dappled woodlands or the margins of meadows (Reid et al. 2021). New Jersey populations are found in woodland glade communities where typical canopy species may include *Carya glabra, Fraxinus americana, Juniperus virginiana, Quercus prinus,* and *Quercus rubra* (Snyder 1994, NJNHP 2022). Some West Virginia sites have been described as meadows dominated by mixed graminoids and forbs; in one location ferns and shrubs were also well-represented (Gregg and Klotz 2015).

Pycnanthemum torreyi has also been found at a number of disturbed sites such as roadsides, trails, orchard edges, and utility right-of-ways (Townsend and Ludwig 2020, Reid et al. 2021,

Weakley et al. 2022, NYNHP 2023). LeBlond et al. (2020) reported a Virginia population at a site that was previously utilized as a pine plantation but had subsequently been restored. The habitat of one West Virginia occurrence was described as "a highly disturbed area surrounded by an active gas well" (Gregg and Klotz 2015). A certain amount of disturbance might be beneficial to *P. torreyi*. One roadside colony in New York has been subject to periodic mowing, although the timing and frequency of the mowing is not known (Lamont and Fitzgerald 2004). Some of the rocky upland communities favored by *P. torreyi* are naturally maintained by fire (Schimp 2005, NYNHP 2023), but the impacts of fire on Torrey's Mountain-mint have not been studied.

Wetland Indicator Status

Pycnanthemum torreyi 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 2023)

PYTO

Coefficient of Conservatism (Walz et al. 2018)

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 torreyi* is restricted to the eastern and central United States (POWO 2023). The map in Figure 1 depicts the extent of *P. torreyi* in North America. The northernmost documented occurrence of the species is in southern New Hampshire (Crow and Storks 1980).

The USDA PLANTS Database (2023) shows records of *Pycnanthemum torreyi* in eight New Jersey counties: Bergen, Essex, Gloucester, Hunterdon, Middlesex, Monmouth, Morris, and Passaic (Figure 2). *P. torreyi* has also been reported in Atlantic County (Britton 1889), Mercer County (Snyder 1994), and Sussex County (NJNHP 2022). The data include historic observations and do not reflect the current distribution of the species.

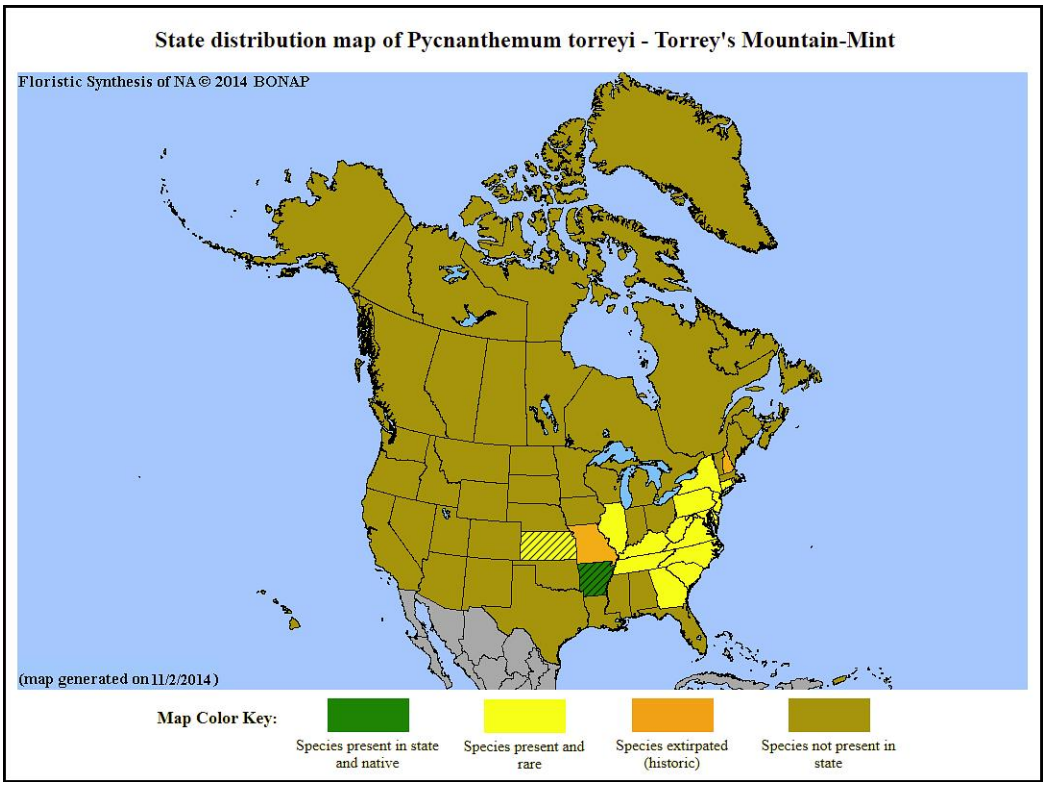

Figure 1. Distribution of P. torreyi in North America, adapted from BONAP (Kartesz 2015). Cross hatching /// indicates a questionable presence.

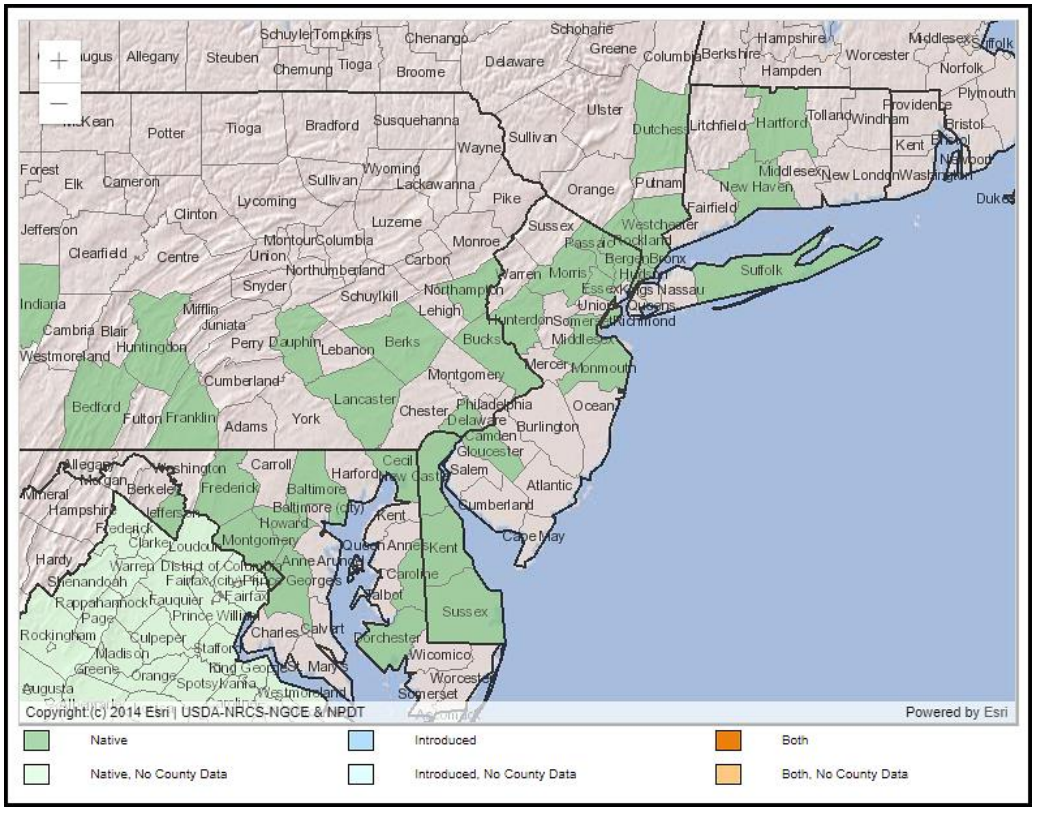

Figure 2. County records of P. torreyi in New Jersey and vicinity (USDA NRCS 2023).

Conservation Status

Pycnanthemum torreyi is globally imperiled. The G2 rank means the species faces a high risk of extinction or collapse due to a restricted range, few populations or occurrences, steep declines, severe threats, or other factors (NatureServe 2023). The map below (Figure 3) illustrates the conservation status of *P. torreyi* throughout its range. Torrey's Mountain-mint is imperiled (high risk of extinction) in two states, critically imperiled (very high risk of extinction) in nine states, possibly extirpated in Delaware, Illinois, and Missouri, and presumed extirpated in the District of Columbia. The species has not been ranked in Kansas or South Carolina, and its status in Georgia is uncertain. *Pycnanthemum torreyi* appears to be in a pattern of decline throughout its range—Ambrose et al. (2015) noted that historical occurrences outnumbered extant occurrences in most of the states where the mountain-mint has previously been documented.

In North America, *Pycnanthemum torreyi* has also 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 rank of R2 (imperiled), signifying a high risk of regional extinction (Frances 2017). Nevertheless, *P. torreyi* has not been reviewed for listing at the federal level (USFWS 2023).

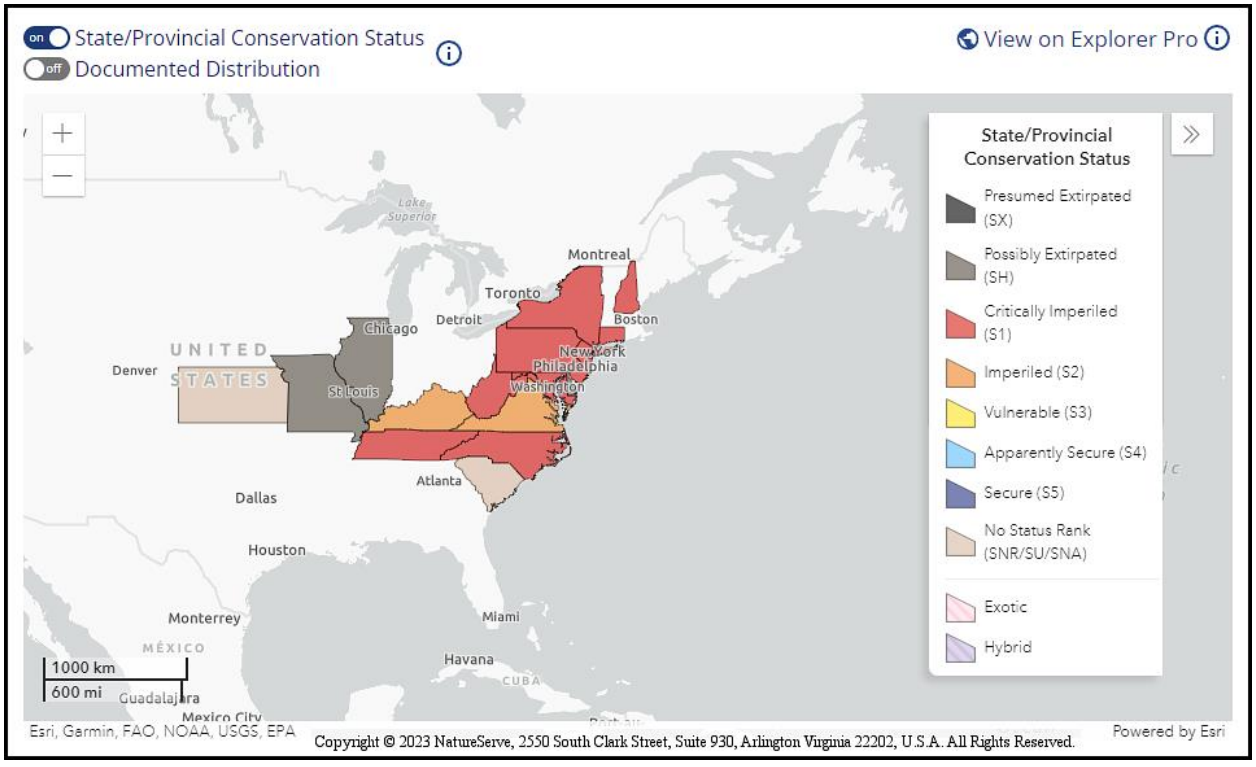

Figure 3. Conservation status of P. torreyi in North America (NatureServe 2023).

Pycnanthemum torreyi is critically imperiled (S1) in New Jersey (NJNHP 2022). 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. torreyi* 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 the plant 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).

The specimen from which *Pycnanthemum torreyi* was described may have originated in New Jersey. John Torrey collected an unknown *Pycnanthemum* when he was living in Princeton and sent a sample to his colleague George Bentham, who was writing a book about the mint family (Fraser and Boom 2020). Bentham's (1834) book eventually produced the first published description of *P. torreyi*. Toward the end of the nineteenth century Torrey's Mountain-mint had been reported from four New Jersey counties (Britton 1889) and more locations were added in the years that followed (Snyder 1994). Observations of the plant evidently trailed off, as Hough (1983) indicated that all known *P. torreyi* records for the state predated 1930. During the 1990s Snyder (1994, 2000) relocated an old site and found a new population, reestablishing the mountain-mint as an extant species in the state. As a result of several subsequent discoveries by Jay Kelly, *P. torreyi* is once again known to be present in four New Jersey counties (NJNHP 2022).

Threats

One of the primary range-wide threats to *Pycnanthemum torreyi* is loss of habitat to invasive flora (Ambrose et al. 2015). Almost every New Jersey occurrence of the mountain-mint is jeopardized by the proliferation of non-indigenous plants, particularly *Lonicera japonica*, *Rubus phoenicolasius*, *Aralia elata*, and *Microstegium vimineum* (NJNHP 2022). All of those species can spread aggressively and are considered highly threatening to native communities (FoHVOS 2022). Populations of *P. torreyi* in utility right-of-ways or travel corridors can also face secondary threats from the indiscriminate spraying of herbicides in an attempt to control the growth of unwanted plants (Ambrose et al. 2015).

Competition from native plants can imperil *Pycnanthemum torreyi* when the unimpeded growth of woody species makes habitats less suitable (Ambrose et al. 2015, NYNHP 2023). Dodge (1997) documented successional changes in one New Jersey forest community linked to a *P. torreyi* occurrence, identifying the invasion of rock outcrop communities by both woody species and non-native plants as point of a major concern. Fire suppression was noted as a possible cause of changes observed at the site.

As with other upland species, individual populations of *Pycnanthemum torreyi* can experience habitat loss or degradation as a result of development, resource extraction, or recreational activities (Ambrose et al. 2015). At one New Jersey site the possible expansion of a nearby quarry was identified as a concern, and the potential for trampling or erosion was noted at two locations where hiking trails are present in close proximity to the plants (NJNHP 2022).

Although no reports of disease in *Pycnanthemum torreyi* were found, the 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*) were also susceptible. *P. torreyi* was not among the species tested (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 one New Jersey population of *Pycnanthemum torreyi* (NJNHP 2022). Mountain-mints are often touted as being "deer-resistant" due to their aromatic foliage, but deer browse has been documented on various *Pycnanthemum* species (Atwood 1941, Miller et al. 1992, Anderson et al. 2001) and *P. muticum* apparently reestablished at a Tennessee site after herbivores were excluded (Griggs et al. 2006).

Gaps in knowledge about *Pycnanthemum torreyi* make it difficult to accurately assess the potential impact of climate change on the species. In addition to rising temperatures, New Jersey communities are experiencing new precipitation patterns that are resulting in both more intense storms and lengthier droughts (Hill 2020). Because the range of *P. torreyi* extends well to the south of New Jersey established plants may have some tolerance for warmer temperatures and a longer growing season. However early season droughts could inhibit seed germination and establishment, while extended wet periods might increase the risk of fungal infection. Invasive plant species, which currently appear to be the most prevalent challenge for *P. torreyi* populations, are likely to become an even greater threat in New Jersey as the climate continues to warm. Bellard et al. (2013) identified the northeastern United States as a probable hotspot for new invasions by nonnative flora, and other evaluations have projected that a number of exotic species which have already gained a foothold in the region are likely to become more abundant (Dukes et al. 2009, Coville et al. 2021, O'Uhuru 2022). Within New Jersey's fragmented landscape, *Pycnanthemum torreyi*'s poor dispersal could limit its opportunities to establish new colonies when existing sites become unsuitable.

Management Summary and Recommendations

Pycnanthemum torreyi is a globally imperiled species that should be prioritized for management. Ambrose et al. (2015) suggested observing extant occurrences of *P. torreyi* on an annual basis to assess population status, habitat quality, and threats. Regular monitoring can help land managers to take prompt action when needed—for example the establishment of a small buffer around one *P. torreyi* occurrence in New York allowed the population to persist even after a shopping center was built on the site (Lamont and Young 2006). Increasing the frequency of site visits might also create opportunities to gather information regarding the species' reproductive vigor or evaluate the extent of herbivore damage.

Suboptimal habitat conditions have been reported for all known populations of *Pycnanthemum torreyi* in New Jersey, and the development of site-specific conservation plans is strongly recommended. Clear management needs such as invasive species control or trail relocation have

already been identified at some sites (NJNHP 2022). Unfortunately, New Jersey has lagged behind many other states in allocating adequate resources to the agencies charged with the protection of rare plants (Mitchell 2023), limiting the capacity for a rapid response when imminent threats are detected. Since only about 35 populations of Torrey's Mountain-mint are thought to remain throughout its entire range (Ambrose et al. 2015), every effort should be made to preserve the integrity and floristic quality of communities that support extant occurrences.

Fire might be an appropriate tool for the management of *Pycnanthemum torreyi* habitat (Schimp 2005, Ambrose et al. 2015, NYNHP 2023) but before that can be recommended studies are needed to determine the timing, frequency, and intensity of burns that would favor the mountain-mint and other rare plants with which it co-occurs. That is just one of many areas where research is needed for *P. torreyi*. Hill (2007) noted the scarcity of basic information regarding the species' life history, population biology, and habitat requirements. Clarification of the taxonomic uncertainties surrounding *P. torreyi* has been called for (Block and Rhoads 2013, Brumback et al. 2013, Ambrose et al. 2015). Due to the global rarity and apparent ongoing decline of *Pycnanthemum torreyi*, consideration should also be given to investigating the species' potential for ex-situ propagation and reintroduction (Hill 2007, Block and Rhoads 2013). An investment in the study of reproduction and transplantation is required before restoration efforts can be contemplated.

Synonyms

The accepted botanical name of the species is *Pycnanthemum torreyi* Benth. Orthographic variants, synonyms, and common names are listed below. A taxon previously described as *Pycnanthemum torrei* var. *leptodon* is now included as a synonym for *Pycnanthemum verticillatum* (ITIS 2021, POWO 2023).

Botanical Synonyms	**Common Names**
Pycnanthemum torrei Benth.	Torrey's Mountain-mint
Koellia torreyi (Benth.) Kuntze	

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