

# *Penstemon laevigatus*

Smooth Beardtongue

Scrophulariaceae



*Penstemon laevigatus* by Alan Weakley, 2020

## *Penstemon laevigatus* 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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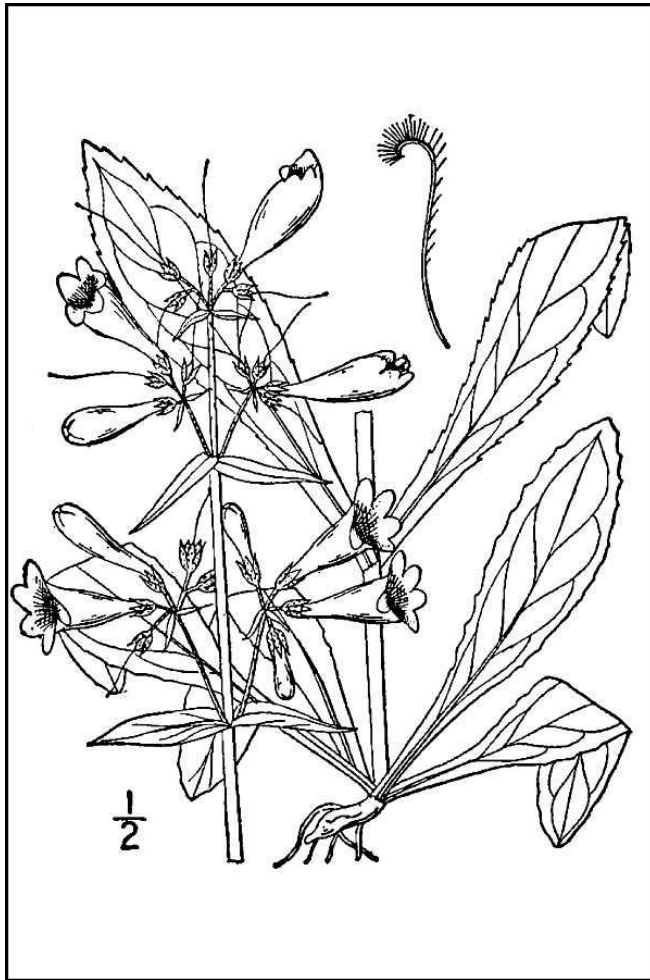
December, 2023

For:  
New Jersey Department of Environmental Protection  
Office of Natural Lands Management  
New Jersey Natural Heritage Program  
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This report should be cited as follows: Dodds, Jill S. 2023. *Penstemon laevigatus* 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, Trenton, NJ. 17 pp.

## Life History

*Penstemon laevigatus* (Smooth Beardtongue) belongs to the third largest genus in North America (Freeman 2020). *Penstemon* has traditionally been included in the Scrophulariaceae but after genetic analyses resulted in fragmentation of the figwort family the genus was transferred to the Plantaginaceae (Oxelmann et al. 2005, Tank et al. 2006). A wide array of floral forms and pollinator syndromes occur within *Penstemon* and the genus even has its own fan club complete with a newsletter called *The Penstemaniac* (APS 2023). *Penstemon* has been divided into subgenera and sections based on morphology and *P. laevigatus* is currently placed in subgenus *Penstemon* section *Penstemon* (Freeman 2020). However, some of the morphological groupings have not been well-supported by molecular studies (Wolfe et al. 2006, Wessinger et al. 2016).



Left: Britton and Brown 1913, courtesy USDA NRCS 2023a. Right: Curtis's Botanical Magazine, 1811.

*Penstemon laevigatus* is a perennial herb, wintering as a basal rosette of leaves that often wither by blooming time (Levine 1995, Freeman 2020). Comparable *Penstemon* species typically form a rosette during their first year and begin to flower in during the second to fourth year (Clements et al. 2002a). *P. laevigatus* seeds planted by Seitz (2018) developed into blooming plants by the second year. Smooth Beardtongue typically flowers between mid-May and mid-June (Pennell

1919) although it can continue into July or early August (Rhoads and Block 2007, Weakley et al. 2022). Woodson et al. (1977) remarked that the blooming of *P. laevigatus* marked the beginning of summer. New Jersey plants have been found in flower and bud during the first week of June (NJNHP 2022). The fruits of *P. laevigatus* mature during July and August (Pennell 1919, Hough 1983), and the capsules are retained on the stem, which remain standing throughout the winter months (Levine 1995).

The basal leaves of *Penstemon laevigatus* are 4–15 cm long and 7–48 mm wide and the margins are smooth or slightly toothed. Three to seven pairs of leaves are present along the stems, which sometimes reach a meter or more in height. The stem leaves are 1.8–12.8 cm long and 8–28 mm wide and they may be short-stalked, sessile, or clasping. The lower part of the stem is relatively smooth although the inflorescence is frequently glandular-hairy. The flowers of *P. laevigatus* have five distinct sepals but the petals are fused to form a two-lipped tube with two lobes on the upper lip and three on the lower lip. *P. laevigatus* flowers are pale violet to purple on the outside while their insides are white with fine purple lines on the lower lobe. Each flower has four normally developed stamens and a fifth that consists of a sterile filament (staminode) with conspicuous yellow hairs. The corollas of *P. laevigatus* are 10–22 mm long and the sepals are 1.5–6 mm long. The fruit is a smooth, ovoid capsule that is 5–8 mm in length. (See Britton and Brown 1913, Pennell 1919, Fernald 1950, Gleason and Cronquist 1991, Clements et al. 1998, Freeman 2020).



Left: David J. Stang, 2006.



Center and Right: Dwayne Estes, 2021.

Morphologically similar species of *Penstemon* can be difficult to distinguish (Deam 1924, Cooperrider 1976, Clements et al. 1998) and four other beardtongues are known to occur in New Jersey (Kartesz 2015). Two of those species, *P. digitalis* and *P. calycosus*, are particularly likely to be confused with *Penstemon laevigatus*: They were at one time considered to be varieties of the latter species and some specimens have intergrading characteristics (Cooperrider 1976, McCready and Cooperrider 1978, Freeman 2020). *P. digitalis* and *P. calycosus* generally have longer corollas (20–35 mm). *P. digitalis* usually has white flowers (although they are sometimes lavender-tinged) and has short hairs on the anthers, whereas the anthers of the other two species are smooth. *P. calycosus* has longer (5–12 mm), more linear sepals. (See Pennell 1935, Estes 2012, Freeman 2020, Weakley et al. 2022).

## Pollinator Dynamics

The design of *Penstemon* flowers favors animal pollination. Pennell (1935) suggested that the bearded staminodes might aid in pollination by providing a foothold for visiting insects and that their bright yellow hairs might additionally serve as a visual attractant. He also noted that the inflated throats allowed bees to fully enter the flowers. Holm (2014) observed that the purple lines on the lower lips of species like *P. digitalis* and *P. laevigatus* could function as nectar guides and that the staminode controlled access to the flowers and aided in pollen deposition. Eumenid wasps seeking nectar often perforate the flowers instead of crawling inside (Robertson 1925).



Bee (*Agapostemon* sp.) inside a *Penstemon* flower, J. S. Dodds, 2023.

Visitors to *Penstemon laevigatus* flowers reported by Robertson (1929) included a variety of long- and short-tongued bees, a syrphid fly, butterflies, a sphinx moth, a beetle, and a hummingbird. *Osmia distincta* is a mason bee that specializes on plants of the genus *Penstemon* (Fowler 2016) and the species has been observed on *P. laevigatus* flowers (Seitz et al. 2020). Generalist foragers such as *Hoplitis pilosifrons*, *Osmia pumila*, and *Anthophora abrupta* have also been documented on *P. laevigatus* (Steury et al. 2009, Graham et al. 2015), and *P. laevigatus* pollen was found in pollen balls on a number of bumblebees (*Bombus* spp.) that were examined by Kettenbach (2018).

The similar flowers of *Penstemon digitalis* receive a comparable assortment of visitors ranging from bees to hummingbirds (Adler and Irwin 2012). Bees are the most important pollinators of *P. digitalis*: Although syrphid flies often feed on *Penstemon* pollen they forage near the entrance which does not result in cross-fertilization (Holm 2014). Parachnowitsch et al. (2012) found that *P. digitalis* flowers at a given site can vary in scent and suggested that the odor of the flowers—although barely detectible to humans—may be more important to reproductive success than visual features like flower size or color.

Self-compatibility has been reported in several related *Penstemon* species, including *P. digitalis* (Holm 2014), and it seems probable that *P. laevigatus* is also self compatible. Clements et al. (1999) determined that both *P. tenuiflorus* and *P. hirsutus* were self-compatible but produced more seeds when they were cross-pollinated.

### **Seed Dispersal and Establishment**

The fruits of North American *Penstemon* species ripen long after anthesis (Pennell 1935). *P. laevigatus* capsules, which contain numerous seeds that are 0.7–1 mm long, split open but remain on the dried stalks (Levine 1995). The seeds are rounded or slightly angled but have no particular adaptations for dispersal (Freeman 2020). *Penstemon* seeds are primarily dispersed by gravity although they can sometimes tumble along the ground in the wind until they become trapped (Fuller and del Moral 2003). Holm (2014) observed that the seeds of *P. digitalis* usually germinate around the parent plants.

Germination in *Penstemon laevigatus* is enhanced by a period of cold stratification. Following six weeks of exposure to temperatures around 5°C, most *P. laevigatus* seeds germinated within a week of planting (Bond 2010). Moisture also improved germination rates. Research on related species (*P. tenuiflorus*, *P. hirsutus*) determined that neither species formed a persistent seed bank and most of the seeds germinated during early spring of the first year following dispersal (Clements et al 2022a). Fungal associations have not been widely studied in *Penstemon* but the two species that have been examined were reported as facultatively mycorrhizal (Wang and Qiu 2006).

### **Habitat**

*Penstemon laevigatus* is capable of growing in a wide variety of habitats at elevations from 10–400 meters above sea level (Freeman 2020). Ryals (2021) indicated that *P. laevigatus* was well-suited for use in a designed prairie community because it was able to tolerate both full sun and dense shade and could function as either a ruderal species or a stress-tolerator. Bond (2010) reported that Smooth Beardtongue grows well in moderately dry soils. Substrates may include loam or clay soils, sandy embankments, or rocky shores (Pennell 1919, Angelo and Boufford 2014).

*Penstemon laevigatus* has been found in fields, meadows, open woodlands, and both lowland and upland hardwood forests. It has also been known to occur in edge habitats and on riverbanks (Pennell 1919, Sefferien 1932, McCready and Cooperrider 1978, Clements et al. 1998, Small and McCarthy 2001, Rhoads and Block 2007, Angelo and Boufford 2014, Weakley et al. 2022). The diverse communities where *P. laevigatus* has been reported include rich lowland forests, mesic prairies, limestone glades, Appalachian shale barrens, and Pine/Scrub oak sandhills (Woodson et al. 1977, Baskin et al. 1995, Kalthorn et al. 2003, Sorrie et al. 2006, Bond 2010). New Jersey habitats have been described as damp meadows, marshy pastures, a successional field with exposed rock outcrops, and a "waste" field (NJNHP 2022). *P. laevigatus* also sometimes grows in disturbed habitat along roadsides or railways (Fogg 1930, Rhoads and Block 2007, Bond 2010, Angelo and Boufford 2014).

**Wetland Indicator Status**

The U. S. Army Corps of Engineers divided the country into a number of regions for use with the National Wetlands Plant List and portions of New Jersey fall into three different regions (Figure 1). *Penstemon laevigatus* has more than one wetland indicator status within the state. In the Atlantic and Gulf Coastal Plain region *P. laevigatus* is a facultative species, meaning that it occurs in both wetlands and nonwetlands. In other parts of the state it is a facultative upland species, meaning that it usually occurs in nonwetlands but may occur in wetlands (U. S. Army Corps of Engineers 2020).

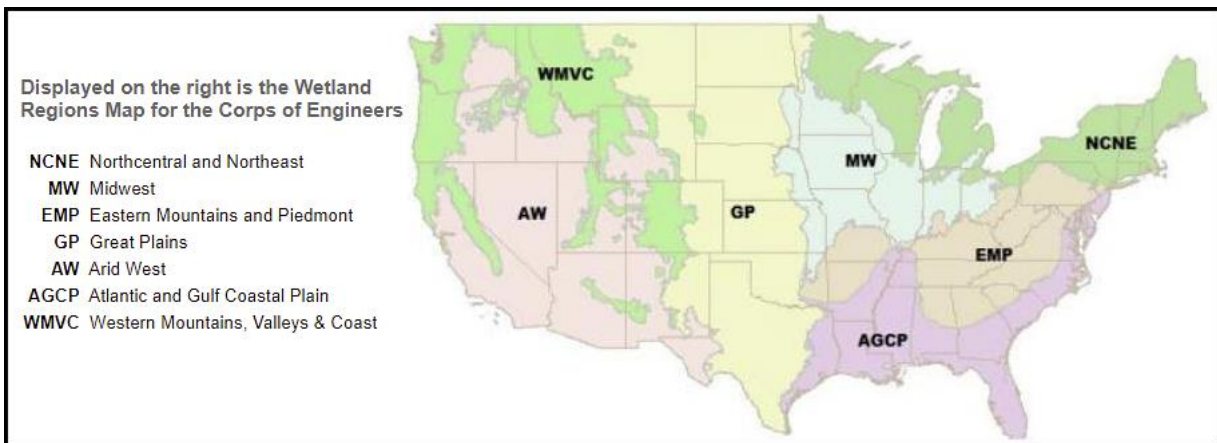


Figure 1. Mainland U. S. wetland regions, adapted from U. S. Army Corps of Engineers (2020).

**USDA Plants Code (USDA, NRCS 2023b)**

PELA8

**Coefficient of Conservancy (Walz et al. 2020)**

CoC = 6. 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 *Penstemon laevigatus* includes parts of the eastern United States and Canada. The map in Figure 2 shows the distribution of Smooth Beardtongue in the United States and some sources consider that to be the full extent of its range (eg. Kartesz 2015, Freeman 2020, POWO 2023). However NatureServe shows it as present in Quebec (see Figure 4) and it was collected in Ontario by Taylor (1947), who noted that the species was spreading northward and had been reported as a weed in some western Quebec farmlands. Pennell (1935) suggested that *P. laevigatus* may have had a more northern range prior to Pleistocene glaciation.

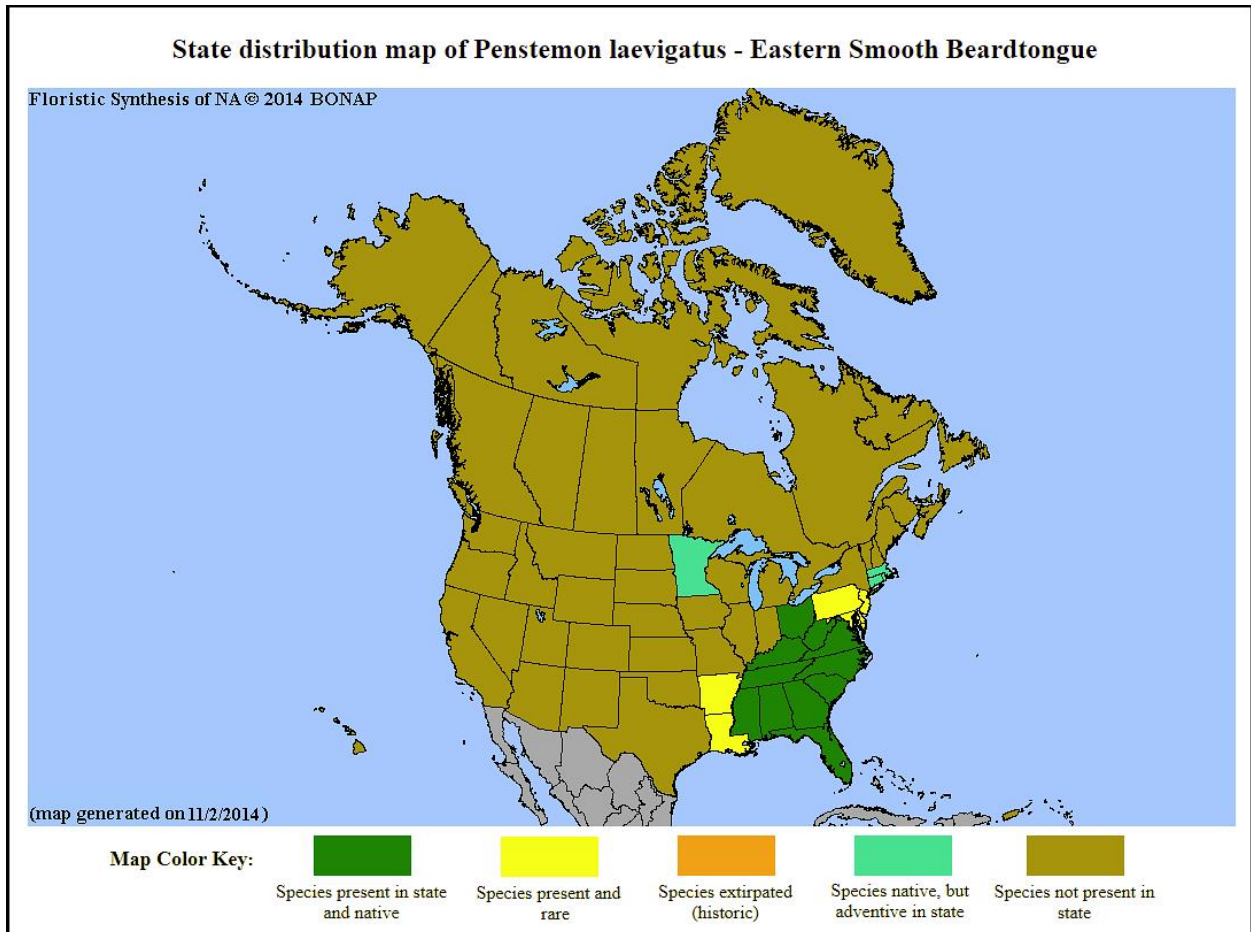


Figure 2. Distribution of *P. laevigatus* in the United States, adapted from BONAP (Kartesz 2015).

The USDA PLANTS Database (2023b) shows records of *Penstemon laevigatus* in nine New Jersey counties: Burlington, Camden, Cumberland, Essex, Gloucester, Hunterdon, Mercer, Middlesex, and Somerset (Figure 3 below). The data include historic observations and do not reflect the current distribution of the species.



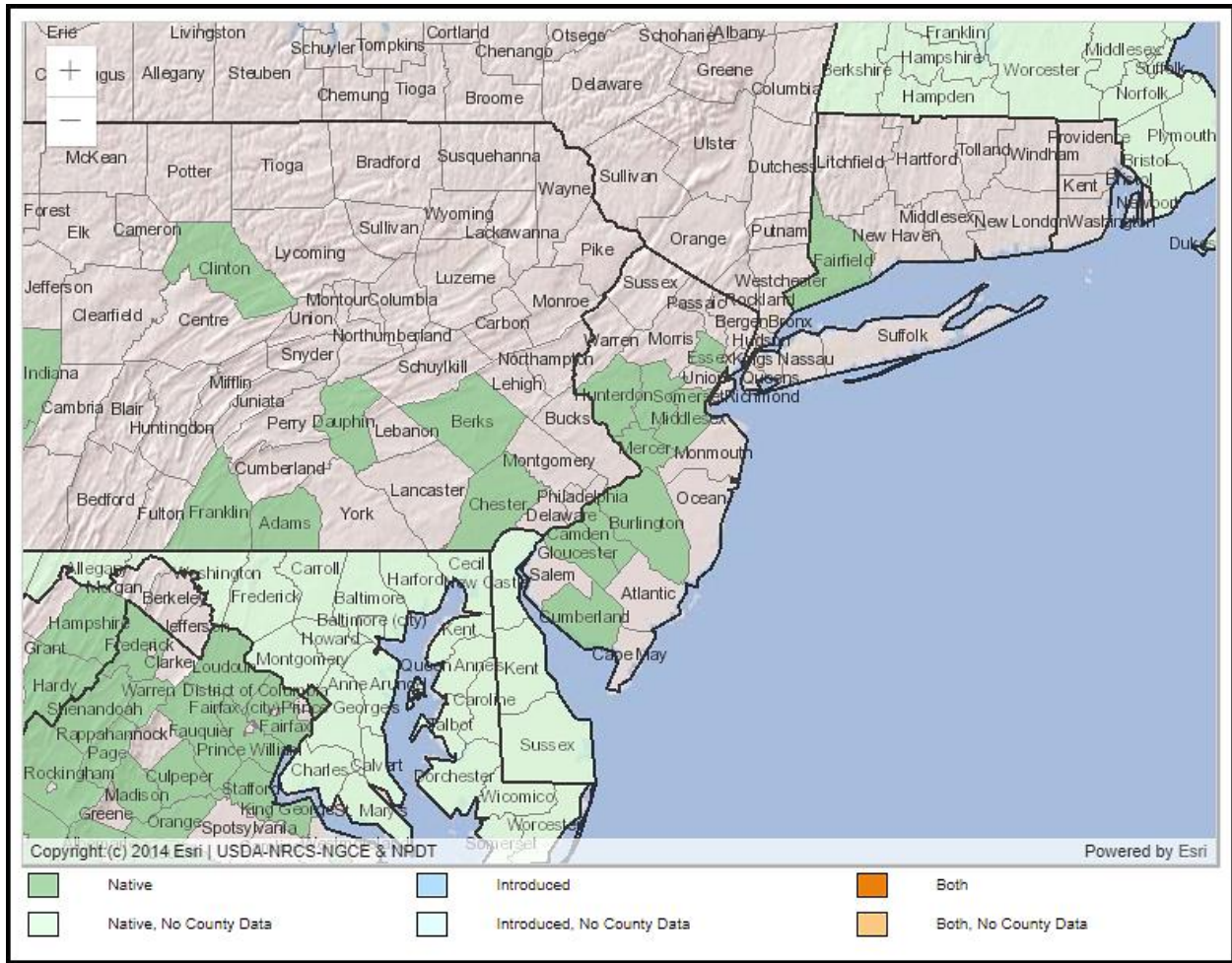


Figure 3. County records of *P. laevigatus* in New Jersey and vicinity (USDA NRCS 2023b).

### Conservation Status

*Penstemon laevigatus* is considered globally secure. The G5 rank means the species has a very low risk of extinction or collapse due to a very extensive range, abundant populations or occurrences, and little to no concern from declines or threats (NatureServe 2023). The map below (Figure 4) illustrates the conservation status of *P. laevigatus* throughout its range. Smooth Beardtongue is vulnerable (moderate risk of extinction) in two states and critically imperiled (very high risk of extinction) in two states. It is considered secure in North Carolina, Virginia, and West Virginia, and it is unranked in other places where it occurs.

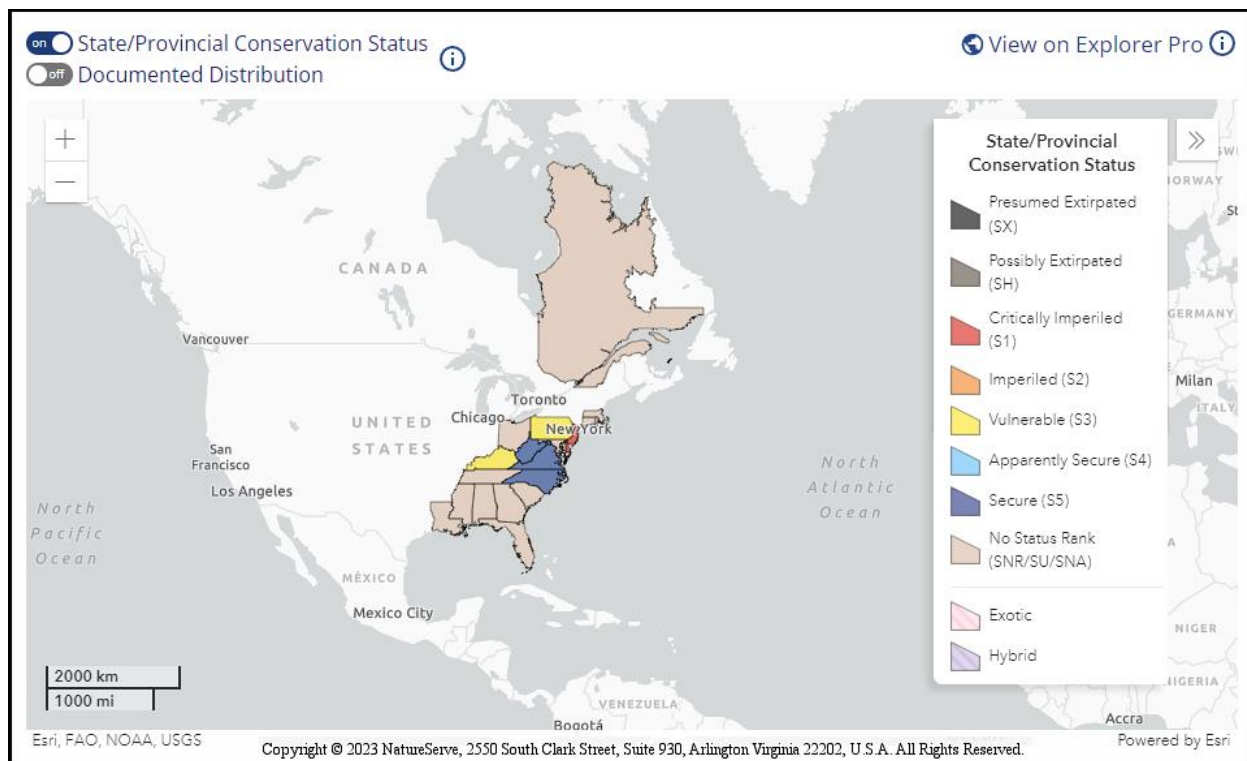


Figure 4. Conservation status of *P. laevigatus* in North America (NatureServe 2023).

New Jersey is one of the states where *Penstemon laevigatus* is critically imperiled (NJNHP 2022). The S1 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. laevigatus* 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. laevigatus* 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).

Although there are records from multiple counties, *Penstemon laevigatus* has never been common in New Jersey. It was not included in early state floras and Taylor (1915) considered it adventive in Pennsylvania, New York, and Connecticut because it was so rarely found in the northeast. Five of New Jersey's seven verified occurrences were only known from single specimens that predated 1940—four of those are extirpated and one is ranked as historical (NJNHP 2022). Aбрайтс (1981) reported a possible *P. laevigatus* occurrence in Hunterdon County and Snyder (2000) subsequently located one extant population in Hunterdon and another in Mercer County. The occurrences documented by Snyder are the only ones that are presently thought to be extant.

## **Threats**

When last observed, one of New Jersey's two extant *Penstemon laevigatus* populations was reportedly threatened by the expansion of a local quarrying operation while loss of habitat to succession was noted as a concern for the second population. The current status of both occurrences is uncertain (NJNHP 2022). As with many upland plants, individual colonies of *P. laevigatus* may be eradicated by habitat development or degradation but no significant widespread threats to the species have been reported.

Herbivory might have a detrimental impact on some occurrences of *Penstemon laevigatus*. Roach (1975) collected larvae of two common moths—*Chloridea virescens* (Tobacco Budworm) and *Helicoverpa zea* (Corn Earworm)—on *P. laevigatus* plants. Both insects are generalists and unlikely to cause extensive harm to Smooth Beardtongue populations. Mammalian browsing has been noted on related species (*P. tenuiflorus* and *P. hirsutus*): Rabbits consumed the leaves and deer ate the inflorescences (Clements et al. 2002a). Heavy deer browse could significantly reduce the reproductive potential of a *P. laevigatus* colony, and in New Jersey the overpopulation of White-tailed Deer (*Odocoileus virginianus*) has been responsible for the decline of other native herbs (Kelly 2019).

As the climate continues to warm, plant communities in New Jersey are increasingly exposed to higher temperatures while shifting precipitation patterns are increasing the frequency and intensity of both droughts and floods (Hill et al. 2020). Available information suggests that the danger to *Penstemon laevigatus* from climate change is relatively low, but a lack of data about some aspects of the species' ecology could result in underestimation of the threat. For example, *P. tenuiflorus* and *P. hirsutus* are both susceptible to lengthy droughts (Clements et al. 2002b) but drought tolerance has not been studied in *P. laevigatus*.

## **Management Summary and Recommendations**

Updated evaluations are needed for both New Jersey populations of *Penstemon laevigatus*, which were last surveyed 30 years ago (NJNHP 2022). Monitoring visits are suggested in order to determine the present extent of each population and to assess current habitat conditions. Any signs of herbivory on the species should also be noted. Further site-specific management planning may be needed depending on the outcome of the updated assessments. There is one historical occurrence for which suitable habitat could still be present, and a search of that site might be worthwhile given the precarious status of *P. laevigatus* in New Jersey.

Much of the information regarding *Penstemon laevigatus* has been derived from casual observations or studies of other species. Management planning for Smooth Beardtongue would benefit from more solid data regarding its ecological requirements. Suggested topics for investigation include long-distance dispersal mechanisms, competitive interactions, fungal associations, and climactic requirements or limitations. *P. laevigatus* is one of the species that has been included in Project Baseline, which is using seeds collected from native flora as a source of genetic representation for comparison with future populations in order to detect any evolutionary changes that may occur during the next half-century (Etterson et al. 2016).

## **Synonyms**

The accepted botanical name of the species is *Penstemon laevigatus* Aiton. Orthographic variants, synonyms, and common names are listed below (ITIS 2021, POWO 2023, USDA NRCS 2023b). The genus name has also been spelled *Pentstemon*.

### **Botanical Synonyms**

*Bartramia pulchella* Salisb.  
*Chelone laevigata* J. Thomps.  
*Chelone laevigata* Pers.  
*Chelone pentstemon* L.  
*Penstemon glaucophyllus* Scheele  
*Penstemon laevigatus* var. *canescens* Britton  
*Penstemon nuttallii* L. C. Beck  
*Penstemon penstemon* (L.) Britton

### **Common Names**

Smooth Beardtongue  
Eastern Smooth Beardtongue

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