

# *Verbena simplex*

**Narrow-leaf Vervain**

**Verbenaceae**



*Verbena simplex* by J. S. Dodds, 2012

## ***Verbena simplex* 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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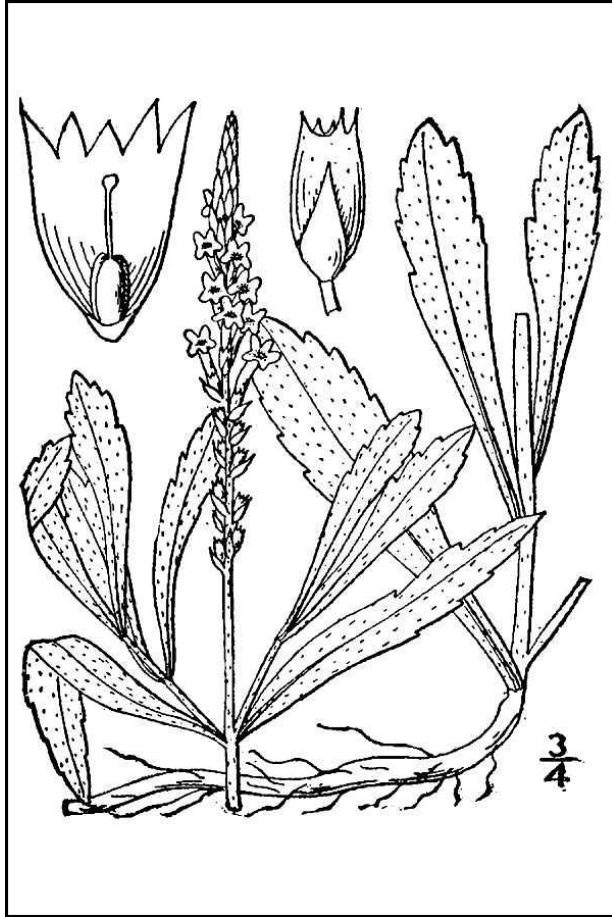
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## **Life History**

*Verbena simplex*, or Narrow-leaf Vervain, is an erect perennial herb 1–7 decimeters in height (4–27 inches) with simple opposite leaves and pale lavender flowers in elongate terminal spikes (Gleason and Cronquist 1991). The stems are smooth or sparsely hairy with one to several ascending branches (Fernald 1950). The narrow (< 1.5 cm wide, length > 6×width) leaves are unlobed and veiny, having teeth at the outer margins and tapering to a sessile or nearly sessile base (Britton and Brown 1913, Weakley 2015). The flowers of *Verbena* plants have a five-parted calyx and corolla with slightly unequal lobes (Gleason and Cronquist 1991). *Verbena simplex* may produce flowers from May to September (Fernald 1950, Weakley 2015) but flowering typically occurs during the summer months (Britton and Brown 1913, Gleason and Cronquist 1991, Rhoads and Block 2007). Hough (1983) reports New Jersey flowering times as "early June to late July, some to September." A detailed description of floral development in *V. simplex* (synonym *V. angustifolia*) is provided by Kanda (1920). Upon maturity, each flower produces four one-seeded linear nutlets (Britton and Brown 1913). *Verbena simplex* develops fruit from early July through mid-September (MANHESP 2015). Groups of four tiny nutlets clinging to dried flower stalks can help to identify *Verbena* plants to genus during the winter months, and features such as height, spike density, and the shape of remnant leaves may aid in determining the species (Levine 1995).

Seven other species of *Verbena* have been reported in New Jersey: Two are native (*V. hastata* and *V. urticifolia*) and five are introduced (Kartesz 2015, Van Clef 2009). *Verbena* ×*engelmannii*, a common hybrid between *V. hastata* and *V. urticifolia* (Weakley 2015), may also be found throughout the state (Kartesz 2015). *Verbena simplex* is readily distinguished from the two other native species and their hybrid, all of which have distinct petioles on the stem leaves. Leaves are also a useful tool to separate *V. simplex* from *V. officinalis* which has lobed leaves and from *V. stricta* which has wider (2–4 cm wide, length < 4×width) leaves. It is unlikely to be confused with several other non-native species that have short, stout floral spikes.

Various species of *Verbena* are known to hybridize spontaneously (Fernald 1950), and *V. simplex* has been reported as hybridizing with *V. stricta*, *V. bracteosa* and *V. hastata* (Barber 1982, Britton and Brown 1913, Gleason and Cronquist 1991). Kanda (1920) observed that hybrids involving *V. simplex* were less common than those between other common species, and suggested that might be due to the slightly earlier peak flowering time of Narrow-leaf Vervain.



Left: Illustration by Britton and Brown 1913, courtesy USDA NRCS 2022a. Right: *V. simplex* plants, J. S. Dodds, 2012.

### **Pollinator Dynamics**

Vervain plants are typically pollinated by insects. Stubbs et al. (1992) list a variety of bees that have been observed visiting flowers in the genus *Verbena*. The mining bee *Calliopsis nebraskensis*, rare in the northeast, is a *Verbena* specialist (Fowler 2016). Mitchell (1960) considered *C. nebraskensis* a midwestern species, but it has been reported from New Jersey and Connecticut (Fowler and Droege 2020). Vervains with a floral morphology similar to that of *Verbena simplex* are pollinated by an array of insects including butterflies, bees, wasps and flies (Perkins et al. 1975), and Tooker et al. (2002) reported that flowers of the Verbenaceae are particularly attractive to butterflies.

Hilty (2020) provided a list of insects specifically associated with *Verbena simplex* that included a skipper, three wasps, a short-tongued bee, and a dozen long-tongued bees. He mentioned that the bees suck nectar or collect pollen while the others simply suck nectar. During a survey of a Narrow-leaf Vervain population in New Jersey, the swarthy skipper (*Nastra lherminier*) was noted as the most frequently encountered insect and bumblebees (*Bombus sp.*) were also observed visiting the flowers (Dodds 2001).

Self-fertilization is possible in *Verbena simplex*, but it is considerably less effective than insect pollination. Barber (1982) experimented with eight *Verbena* species and found that *V. simplex* had a 16.1% seed set following self-pollination while cross-pollinated plants had a 97.2% seed set.

### **Seed Dispersal**

The nutlets of *Verbena simplex* are 2–3 millimeters long and have a reticulate surface (Gleason and Cronquist 1991). No studies were found on dispersal in the species. Platt (1975) reports wind dispersal in *V. stricta*, and Howe (1982) cites *Verbena* as a wind-dispersed genus. A European study achieved limited germination of *V. officinalis* from sheep dung samples (Kuiters and Huiskes 2010), suggesting the possibility of some herbivore-mediated dispersal in the genus. Hilty (2020) notes that *Verbena simplex* seeds are a minor food source for a number of birds in the Great Plains, but it is unclear whether that results in the dispersal of viable seeds.

*Verbena simplex* seeds may remain in the soil for a number of years prior to germination, though the full extent of seed viability is unknown. In one study conducted in a greenhouse setting, *V. simplex* germination peaked the first spring after planting but some of the seeds continued to germinate each spring for the next four years (Baskin and Baskin 1988). A Georgia survey of herbaceous plants in a Longleaf Pine (*Pinus palustris*) community found that *V. simplex* was among a group of species not previously known from the site, characterizing the group as "*transient species likely to have responded to recent management-induced disturbances*" (Cipollini et al. 2012). The series of management disturbances, previously implemented as part of habitat restoration efforts, had resulted in reduced canopy density and leaf litter. However, it was not clear whether the Vervain plants emerged from the seed bank or whether seeds that were more recently dispersed from another location then germinated rapidly due to favorable site conditions. Another vegetation analysis in eastern Pennsylvania recorded *V. simplex* as present in a seed bank although it was not found in the extant vegetation onsite (Williams 2013).

### **Habitat**

*Verbena simplex* is often associated with early successional habitats and disturbed sites (Quarterman 1957, Elliman 2001). Hilty (2020) summarizes the plant's preferred habitat as "sunny areas with scant vegetation". Some specific places where the species has been found include dry hillsides, fields, grassy summits, limestone glades and barrens, prairies, quarry wall shelves, railroad banks, roadsides and roadside ditches, rock outcrops, sandplains, shale barrens, traprock ledges, wood edges, woodlands, and xeric limestone prairies (Bartgis 1993, Lawless et al. 2004, MANHESP 2015, Minnesota DNR 2021, Rhoads and Block 2007, Sorrie 1987, Tryon and Moore 1946, Weakley 2015).

At one site in New Jersey, a fairly large population of *Verbena simplex* was surveyed that occupied three sub-habitats (Dodds 2001). The most vigorous plants—in terms of number of flowering spikes and overall height—were growing in loose fill soil along a roadside edge where they were exposed to full sun. The other plants were situated along old railroad bed with tightly

compacted soil that included gravel and cinders. One section of the rail bed habitat was in full sun while the other was partially to fully shaded, and those in the open section had more numerous stems and flower spikes than the plants in the shade. Seedlings and immature plants were seen exclusively in areas devoid of a litter layer and without established vegetation, and no juvenile plants were growing in the road edge habitat which was heavily vegetated with an assortment of species including bush clovers (*Lespedeza spp.*), Spotted Knapweed (*Centaurea stoebe ssp. micranthos*), goldenrods (*Solidago spp.*), and Everlasting Pea (*Lathyrus latifolius*). Vegetation on the railroad bed was sparse, and included Buttonweed (*Diodia teres*), Bracted Plantain (*Plantago aristata*), Orange-grass (*Hypericum gentianoides*), and Blue-curls (*Trichostema dichotomum*). Approximately a decade later plants along the railroad bed were thriving but the roadside population had been reduced to a few plants (Dodds 2012, unpublished data).

### **Wetland Indicator Status**

*Verbena simplex* 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 2022b)**

VESI

### **Coefficient of Conservatism (Walz et al., 2018)**

CoC = 4. Criteria for a value of 3 to 5: Native with an intermediate range of ecological tolerances and may typify a stable native community, but may also persist under some anthropogenic disturbance (Faber-Langendoen 2018).

### **Distribution and Range**

The map in Figure 1 (below) depicts the extent of Narrow-leaf Vervain in the United States and Canada. The global range of *Verbena simplex* also extends into northwestern Mexico (POWO 2021).

It appears that *Verbena simplex* was formerly found in every county in New Jersey. The USDA PLANTS Database (2022b) shows records of *V. simplex* in all but two counties (Figure 2). The species was also reported as an occasional occurrence in Cumberland County (Moore 1989), and appeared on a list of Salem County's special plants (NJ Division of Parks and Forestry 2014). The data include historic observations and do not reflect the current distribution of the species.

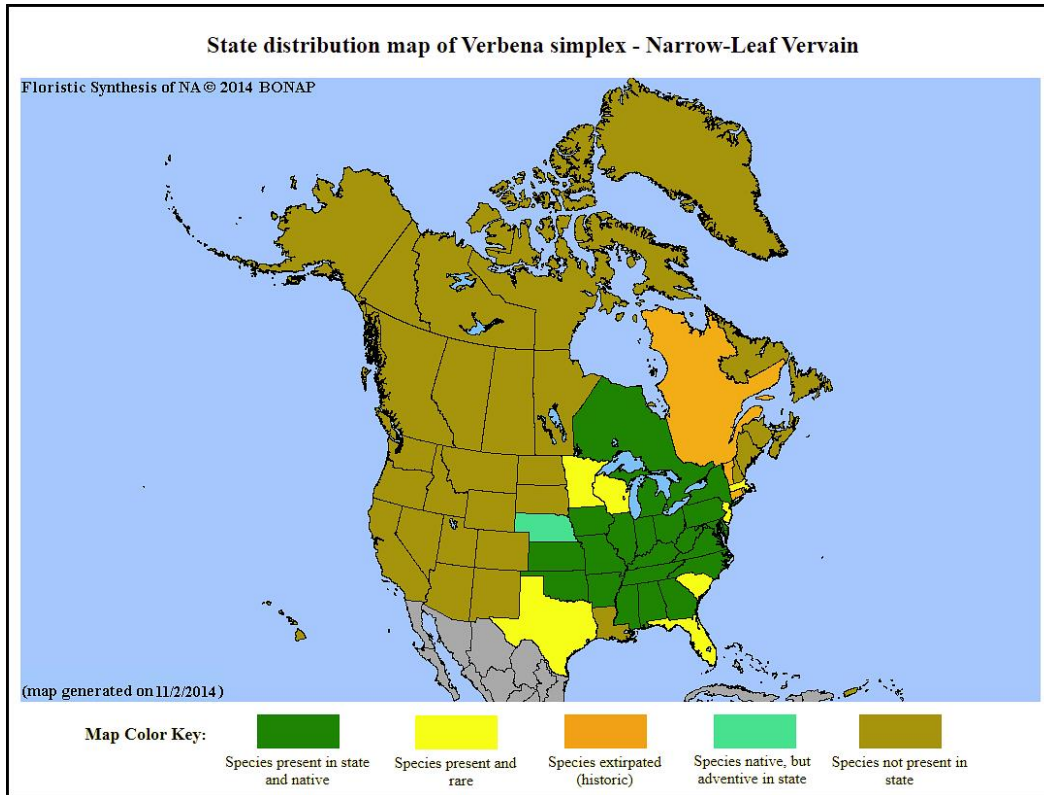


Figure 1. Distribution of *V. simplex* in North America, adapted from BONAP (Kartesz 2015).

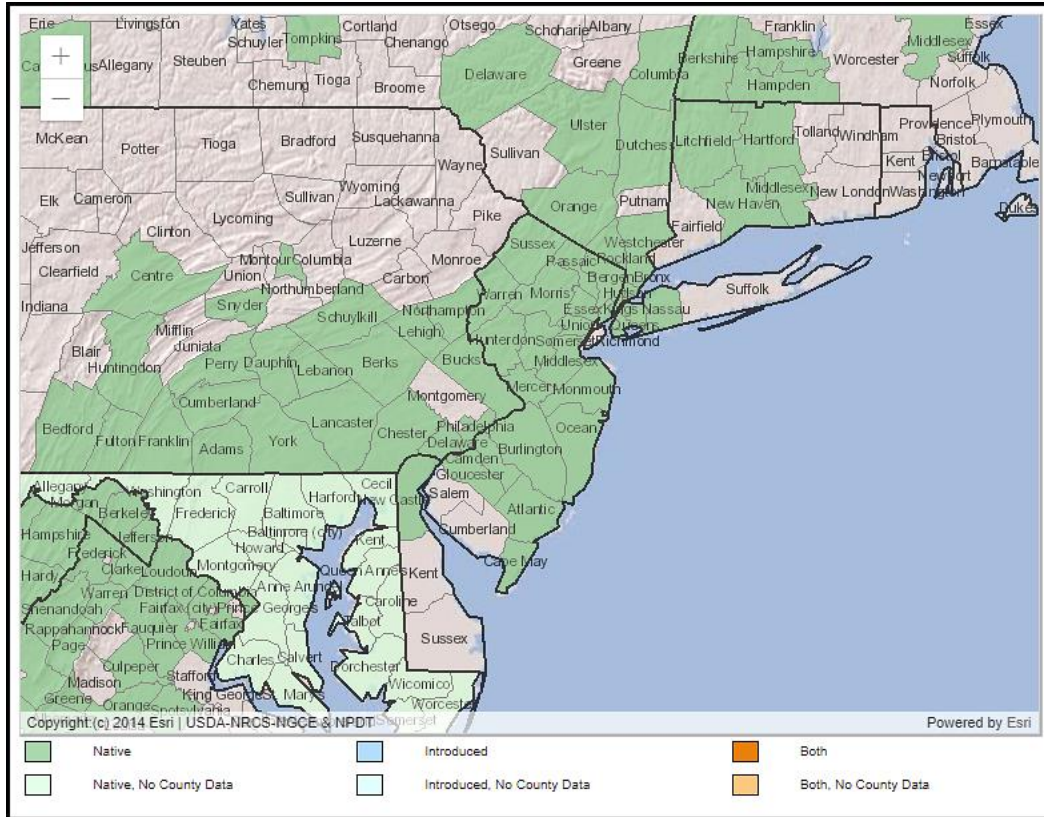


Figure 2. County records of *V. simplex* in New Jersey and vicinity (USDA NRCS 2022b).

## Conservation Status

*Verbena simplex* 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 2022). The map below (Figure 3) illustrates the state or provincial conservation status of Narrow-leaf Vervain throughout the United States and Canada. The species is considered secure or apparently secure throughout much of its range. However, it is listed as vulnerable (moderate risk of extinction) in one state, imperiled (high risk of extinction) in one state, and critically imperiled (very high risk of extinction) in five states and the Canadian province of Quebec. It is also reported as possibly extirpated in two New England states.

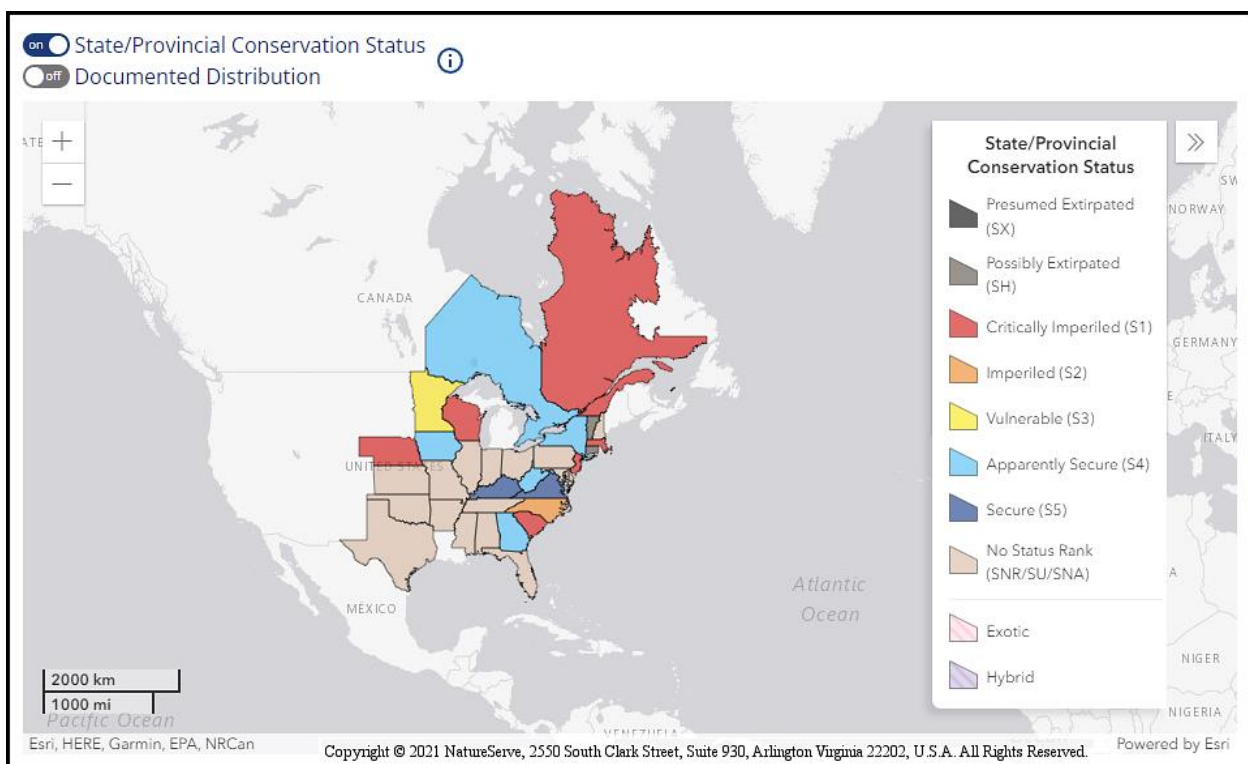


Figure 3. Conservation Status of *V. simplex* in North America (NatureServe 2022).

In New Jersey, *Verbena simplex* is critically imperiled (S1) (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. Narrow-leaf Vervain 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 the 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 in the New Jersey Pinelands (LP) (NJNHP 2010).



Historic records indicate that Narrow-leaf Vervain was once fairly common throughout the state. Britton (1889) reported the species from seven northern counties and noted that it was "*frequent in the middle and southern counties.*" Keller and Brown (1905) reported it in six central and southern New Jersey counties in the vicinity of Philadelphia. Stone (1911) said it was occasional throughout the state, particularly on the Inner Coastal Plain, and noted that the plant was "*a weed in many places, and the few Pine Barrens records are to be so regarded.*" Nearly a century later, *Verbena simplex* was scarce in New Jersey. In 1989, the Endangered Plant Species List Act was enacted (NJ Division of Parks and Forestry 2007), and the following year *Verbena simplex* was on the state's first Endangered Plants List (NJ ONLM 1990). The subsequent version of the list was expanded to include additional rare plant species and their ranks in New Jersey, at which time *Verbena simplex* was thought to be historic in the state (NJ ONLM 1992).

The species was reported at a Hudson County site in 1989 (Anderson 1990), although no information about the size or extent of the occurrence was provided and the current status of the population is unknown. Another population was discovered in Atlantic County in 1994, and was given an estimated viability rank of 'Good' based on survey data from 2001 (NJNHP 2022). The population is still present although it has decreased in size (Federal Aviation Administration 2018, unpublished data). Two additional occurrences are now known in the state, one with a viability rank of 'Fair' and one that has yet to be ranked (NJNHP 2022).

## **Threats**

*Verbena simplex* is a species of open upland habitats with sparse vegetation. Frequently cited threats are direct competition with other plants and canopy closure due to natural succession (Go Botany 2022, Elliman 2001). Elliman also reported change in moisture regime as something *V. simplex* does not tolerate, perhaps because it makes the habitat more accessible to a greater number of plant species. In Massachusetts, the loss of available habitat suitable for *V. simplex* has been attributed to a decrease in disturbances that help maintain open communities such as natural fires, forest cutting, and grazing (MANHESP 2015).

Farnsworth (2004) studied impacts from invasive plants on 81 rare plant species in the New England states. Farnsworth did not find invasives at the *V. simplex* sites that were included in her analysis, and noted that many of the region's most problematic invasive plants were concentrated in wetland habitats. In southern New Jersey, dry open habitats are often colonized by *Lespedeza cuneata* (Chinese Bush-clover) which forms dense stands that exclude other plant species. The plant is ranked as a high threat to natural communities (Van Clef 2009), and its rapid proliferation could accelerate the detrimental effects of competition or succession if established in *V. simplex* habitat.

A related species (*V. officinalis*) with life history characteristics similar to those of *V. simplex* was evaluated for tolerance to low temperatures (Woodward 1997). In *V. officinalis*, mortality occurs between -4°C (24.8°F) and -17°C (1.4°F) with 100% mortality at the lower end of the spectrum. A threshold temperature of 16°C (60.8°F) was needed for flowering, while seed germination required a mean temperature above 14°C (57.2°F) and a daytime temperature greater than 19°C (66.2°F). Limitations relative to high temperature extremes were not investigated.

Hilty (2020) reported two insects that preferentially feed on *Verbena* spp.: *Macrosiphum verbenae* (Verbena Aphid) and *Crambodes talidiformis* (Verbena Moth). Blackman and Eastop (2006) contend that the aphid species is poorly documented and records of it may actually be *M. euphorbiae*, a generalist feeder. The moth, however, appears to be specialist: Larvae of *C. talidiformis* feed exclusively on *Verbena* leaves (Crumb 1956, Williams 2003). Both insects are present in New Jersey (BugGuide 2022). Another moth that has been associated with *Verbena*, while not a specialist on the genus, may be more harmful to Vervain plants. *Endothenia hebesana* (Verbena Bud Moth) selectively feeds on the flowers, stems and seed capsules of *Verbena*, as well as flowers from other plant families (Miller 1987). The moth's common name is attributed to Mary Treat, who deemed it a "terrible nuisance", reporting that the larvae had completely destroyed the flowers on her *Verbena* plants (Treat 1870). Further study of the insect was undertaken by Fink (1915), who found that *E. hebesana* larvae fed on developing flowers and seeds, rendering the infested plants "worthless".



*Endothenia hebesana* (Verbena Bud Moth), J. S. Dodds, 2021

The Verbena Bud Moth is a native and common species in New Jersey, and is frequently encountered in the northern and central parts of the state (Dodds, unpublished data). While insect pests do not appear to be a primary threat to *Verbena simplex*, an infestation that inhibited the plant's ability to thrive and reproduce could take heavy toll on a small population. Mammalian herbivory has also been noted as a threat to one New Jersey *V. simplex* occurrence (NJNHP 2022).

### **Management Summary and Recommendations**

It seems clear that the preservation of *Verbena simplex* in New Jersey will hinge on maintenance of open habitat at sites where it is extant. While established plants may tolerate a period of competition as other species move into their environment, seedlings need space that is free of both competitors and leaf litter. No data was found on the longevity of *V. simplex* plants, but

Woodward (1997) estimated a 5–10 year lifespan for *V. officinalis* based on observed mortality rates.

Even in Kentucky and West Virginia where the species is ranked as secure, *V. simplex* occurs in plant communities that were formed by long-term human disturbances. For example, limestone barrens originated from periodic burning prior to European settlement, while xeric prairies were formed by clearing for agriculture that was followed by overgrazing and subsequent erosion (Lawless et al. 2004). Today, many of those barrens and glade woodlands communities are naturally maintained by drought stress and fire (Bartgis 1993). Some management tools suggested to mimic the natural processes that maintain open habitat include canopy thinning or prescribed burns (MANHESP 2015).

Fire has been successfully applied as a habitat restoration tool in barrens communities in Illinois (Stritch 1990). Following some moderate success using traditional controlled fires in selected areas, a landscape-level experiment allowing the path of a large fire to be guided by local topography, air currents and temperature differentials resulted in a mosaic of burned and unburned patches and restored natural structure and vigor of the community. While the technique may not be practical in New Jersey, site-specific management plans might consider how partial burns or variations in fire intensity would be likely to affect species composition at targeted locations.

Habitat scarification had a favorable outcome for one *Verbena simplex* population in New England (Elliman 2001). However, Snyder (2013) points out the importance of thoughtful planning and careful execution when utilizing the technique, as misapplication can result in a host of unintended consequences including soil erosion and compaction, damage to native plants, and the introduction of invasive species.

A more complete understanding of the biology of *Verbena simplex* is desirable in order to effectively plan for management of the species. Suggested areas for additional research include seed dispersal mechanisms, persistence in the seed bank, and evaluation of the impact of insect damage on reproduction. Additional data regarding the frequency and extent of herbivory by mammals would also be useful in conservation planning.

Thirteen New Jersey occurrences are labeled as historic (NJNHP 2022). The rank is often applied when sites where the species formerly occurred may still have suitable habitat but have not been thoroughly searched (Snyder 1993). Many of the state's older *V. simplex* records contain few details regarding the locations where specimens were collected, but in those cases where a reasonable deduction can be made from available information suitable habitat should be searched. Based on the breadth of the species' former range throughout the state, it seems likely that targeted efforts could turn up a few extant occurrences.

Because Narrow-leaf Vervain was once more abundant in the state, restoration of the species at sites where it formerly occurred might be appropriate as a long-term management option. Initial steps could include updated surveys for the plant at historic sites or searches of nearby locations with suitable habitat. The New England Wild Flower Society has collected and stored seeds from native *Verbena simplex* plants and has also experimented with germination techniques

(Elliman 2001). Building on their results, the knowledge could be applied to evaluate the potential for the reintroduction of the rare species in New Jersey.

### **Synonyms**

The accepted botanical name of the species is *Verbena simplex* Lehmann. Orthographic variants, synonyms, and common names are listed below (ITIS 2021, USDA 2022b).

#### **Botanical Synonyms**

*Verbena angustifolia* Michx.

#### **Common Names**

Narrow-leaf Vervain  
Narrowleaf Vervain  
Narrow-leaved Vervain  
Simple Verbena

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