# *Maianthemum trifolium*

## Three-leaf False Solomon's-seal

## Ruscaceae

*Maianthemum trifolium* by Peter M. Dziuk, 2010

## *Maianthemum trifolium* 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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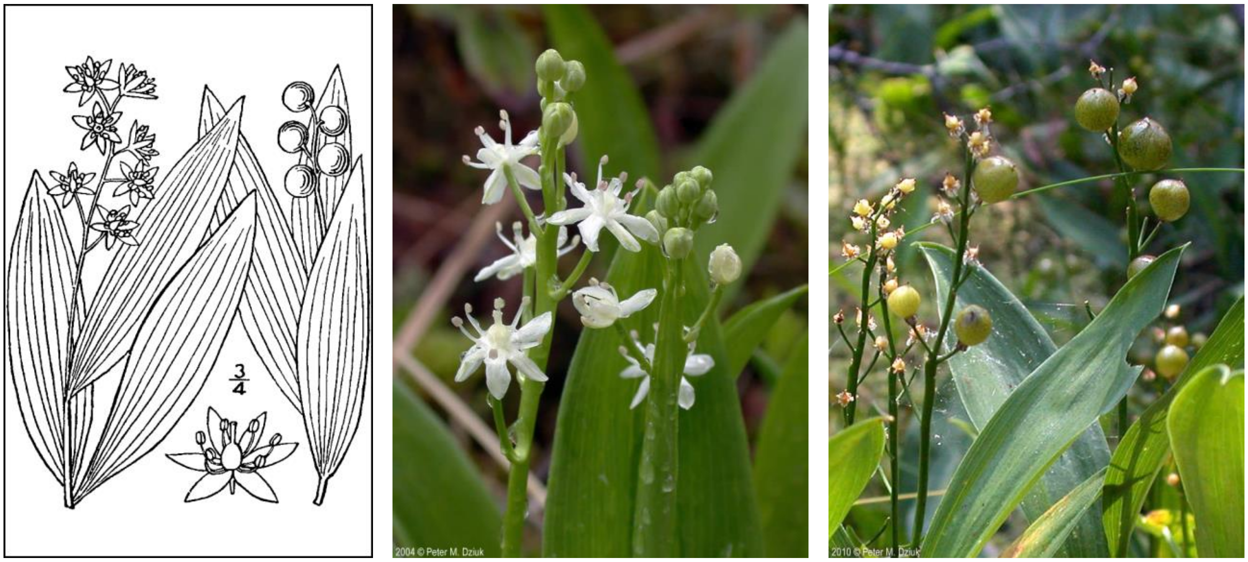
## Life History

*Maianthemum trifolium* (Three-leaf False Solomon's-seal) is a rhizomatous perennial herb that can form extensive colonies via clonal reproduction. *Maianthemum* was traditionally included in the Liliaceae but it is now placed in the Butcher's-broom family (Ruscaceae), which some authors include within a more broadly defined Asparagaceae (Kartesz 2015, APG IV 2016, Weakley et al. 2024). The synonym *Smilacina trifolia* is still widely used (see Synonyms and Taxonomy section).

The slender rhizomes of *Maianthemum trifolium* develop in sections and roots are produced at the nodes. The aboveground stems are usually under 2.5 dm in height and 2–3 mm wide. Vegetative plants have two leaves with petioles, while flowering stems have 2–4 (typically 3) sessile leaves. The parallel-veined leaves are alternate, lance-shaped, 5–12 cm long by 2.5–4 cm wide, and tapering at the base. The inflorescence of *M. trifolium* is a simple raceme of 5–15 long-stalked flowers, each of which has six white tepals 2.5–4 mm in length and six stamens. The berrylike fruits are 4–6 mm in diameter: They are initially red-spotted but become dark red at maturity. Three other *Maianthemum* species are native to New Jersey but they are easy to distinguish when the plants are in bloom. *M. canadense* flowers have four tepals, *M. racemosum* has numerous (70+) flowers in a branching inflorescence, and the flowering shoots of *M. stellatum* have 6–11 leaves. (See Britton and Brown 1913, McAvoy 1913, Galway 1945, Fernald 1950, LaFrankie 1986a & 2020, Gleason and Cronquist 1991). It is interesting to note that *M. trifolium* is more closely related to Asian *Maianthemum species* than it is to other members of the genus that occur in North America (Kim and Lee 2007).



Left: Britton and Brown 1913, courtesy USDA NRCS 2025a. Center and Right: Peter M. Dziuk, 2004 and 2010.

*Maianthemum trifolium* blooms in May or June and the fruits develop during July and August, although some may be retained through September (Hough 1983, LaFrankie 1986a, Rhoads and Block 2007, Weakley et al. 2024). Vegetative and floral buds are initiated in the summertime and the shoots emerge the following spring (LaFrankie 1985). The photosynthetic capacity of *M.*

*trifolium* peaks in July and the leaves are discarded in the fall, with senescence usually completed by the end of October (Jensen et al. 2019).

## Pollinator Dynamics

*Maianthemum* flowers produce nectar (LaFrankie 1986a) and are notably fragrant (Skeels and Langdon 1896, Genders 1977). They attract an array of insect visitors including small bees, wasps, flies, butterflies, moths, and beetles (Robertson 1929, LaFrankie 1986a, Stubbs et al. 1992, Holm 2014, Hilty 2020). Small (1976) documented 18 kinds of flies, 3 bees, and 1 beetle on *Maianthemum trifolium* in Ottawa. The closely related *M. japonica* is also primarily fertilized by flies, and fly pollination generally results in consistent seed set (Kudo et al. 2008).

Not all *Maianthemum* species are self-compatible but Wheelwright et al. (2006) recorded 75% fruit set in *M. trifolium* when pollinators were excluded. Follow-up experimentation showed that there was no difference in fruit set whether *M. trifolium* plants were self-pollinated by hand, hand-outcrossed, or open-pollinated by insects. The authors concluded that the species is capable of self-fertilization in the absence of insect activity and does not experience pollinator limitation or inbreeding depression.

## Seed Dispersal and Establishment

The berrylike fruits of *Maianthemum* plants are eaten by birds and small mammals (Galway 1945, Piper 1986, Hilty 2020). Some may occasionally be consumed by large mammals that browse on the foliage. Birds are probably the primary dispersers of *Maianthemum trifolium* seeds. Piper (1986) included *M. stellatum* and *M. racemosum* in a study of bird dispersed plants. He found that the fruits turned red as the seeds matured, and monitoring of those species indicated that birds did not consume the berries before they were ripe. *M. trifolium* berries have been historically utilized for medicinal purposes (Galway 1945), but humans are not likely to discard the seeds in sites that are suitable for germination.

*Maianthemum* seedlings develop slowly and they seem to require multiple periods of exposure to cool temperatures. The young plants typically do not produce any foliage during their first growing season, then develop a single leaf the second year and two the third year before they finally become reproductive. Occasionally the process is accelerated. Vegetative reproduction in *Maianthemum trifolium* proceeds in a similar fashion because the branching rhizomes become fragmented and clones have to establish independently. New shoots are initiated the first year but remain in bud, second year plants are vegetative and consist of two petiolate leaves, and flowering stems emerge during the third year (LaFrankie 1985).

It is not clear whether *Maianthemum trifolium* forms mycorrhizae as the plants are developing. Wieder et al. (2022) characterized *M. trifolium* as a nonmycorrhizal species. In contrast, *M. racemosum* tends to be strongly mycorrhizal, although somewhat less so in lowland habitats with greater moisture availability (Demars and Boerner 1995). Addy et al. (2000) isolated a common endophyte (*Phialocephala fortinii*) from the roots of *M. trifolium* plants but noted that the fungus has variable effects on its hosts and not all of the associations are beneficial.

## Habitat

*Maianthemum trifolium* can occur from sea level up to elevations of 1000 meters (LaFrankie 1986a) but it has fairly narrow habitat requirements. The species is typically associated with cold, acidic northern bogs and peaty wetlands, both in North American and in Asia (Harper 1918, Galway 1945, Kawano and Iltis 1966, Hough 1983, Angelo and Boufford 2000, Humphreys et al. 2006, Rhoads and Block 2007). The plants have been found growing on floating sphagnum mats and in organic soils that were 30 cm deep (Henry 1950, LaFrankie 1985, Addy et al. 2000). *M. trifolium* seems to prefer the lower, wetter portions of the habitats it utilizes, such as the margins of ponded areas in *Sphagnum* bogs (Thompson 1911) or the level areas in wetlands with a mounded microtopography (Echiverri et al. 2020).

*Maianthemum trifolium* was listed as a plant of moderately acidic soils by Wherry (1920), and Jeglum (1971) indicated that the species was characteristic of very oligotrophic sites with pH values of 3.0–3.9. The pH noted at a Wisconsin site was 4.0 (Beals 1965) while those recorded in Maine wetlands were more variable, typically ranging from 4.27–5.21; however, *M. trifolium* was also detected—but not common—at a site with a mean pH of 7.54 (Anderson and Davis 1998).

Humbert et al. (2007) assigned *Maianthemum trifolium* a rank of 8 in a shade tolerance index ranging between 1 (very tolerant) and 9 (very intolerant), indicating that it strongly favors open conditions. Using a similar scale from 1–9, Weakley et al. (2024) ranked the species as a 4, meaning that it is likely to do well in either sun or shade or even display a slight preference for shaded sites. The wider range of tolerance is probably more accurate, as the habitats utilized by the species vary from open bogs to forested sites (LaFrankie 1986a), but it is possible that the species reproduces more vigorously in response to higher levels of light.

*Maianthemum trifolium* is often associated with mid-to late-successional spruce/tamarack (*Picea mariana*/*Larix laricina*) bogs but it has occasionally been found in sites where *Thuja occidentalis*, *Populus tremuloides*, *Tsuga canadensis*, or *Acer rubrum* were prevalent. Characteristic shrubs may include *Alnus incana* ssp. *rugosa*, *Chamaedaphne calyculata*, *Gaylussacia baccata, Rhododendron* spp., or *Vaccinium* spp. Sphagnum mosses are usually dominant on the ground, and common herbaceous associates include *Menyanthes trifoliata*, *Calla palustris*, *Coptis trifolia*, *Eriophorum* spp., and *Carex* spp. (Henry 1950, Beals 1965, Brumelis and Carleton 1989, Schaefer and Pruitt 1991, Addy et al. 2000, Breden et al. 2001, Pellerin et al. 2009, Echiverri et al. 2020, Standen and Balzer 2021, NJNHP 2024).

## Wetland Indicator Status

*Maianthemum trifolium* is an obligate wetland species, meaning that it almost always occurs in wetlands (U. S. Army Corps of Engineers 2022).

## USDA Plants Code (USDA, NRCS 2025b)

MATR4

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

CoC = 9. Criteria for a value of 9 to 10: Native with a narrow range of ecological tolerances, high fidelity to particular habitat conditions, and sensitive to anthropogenic disturbance (Faber-Langendoen 2018).

## Distribution and Range

The native range of *Maianthemum trifolium* extends throughout Canada and includes parts of the northeastern United States and northern Asia (POWO 2025). The map in Figure 1 depicts the extent of the species in North America.

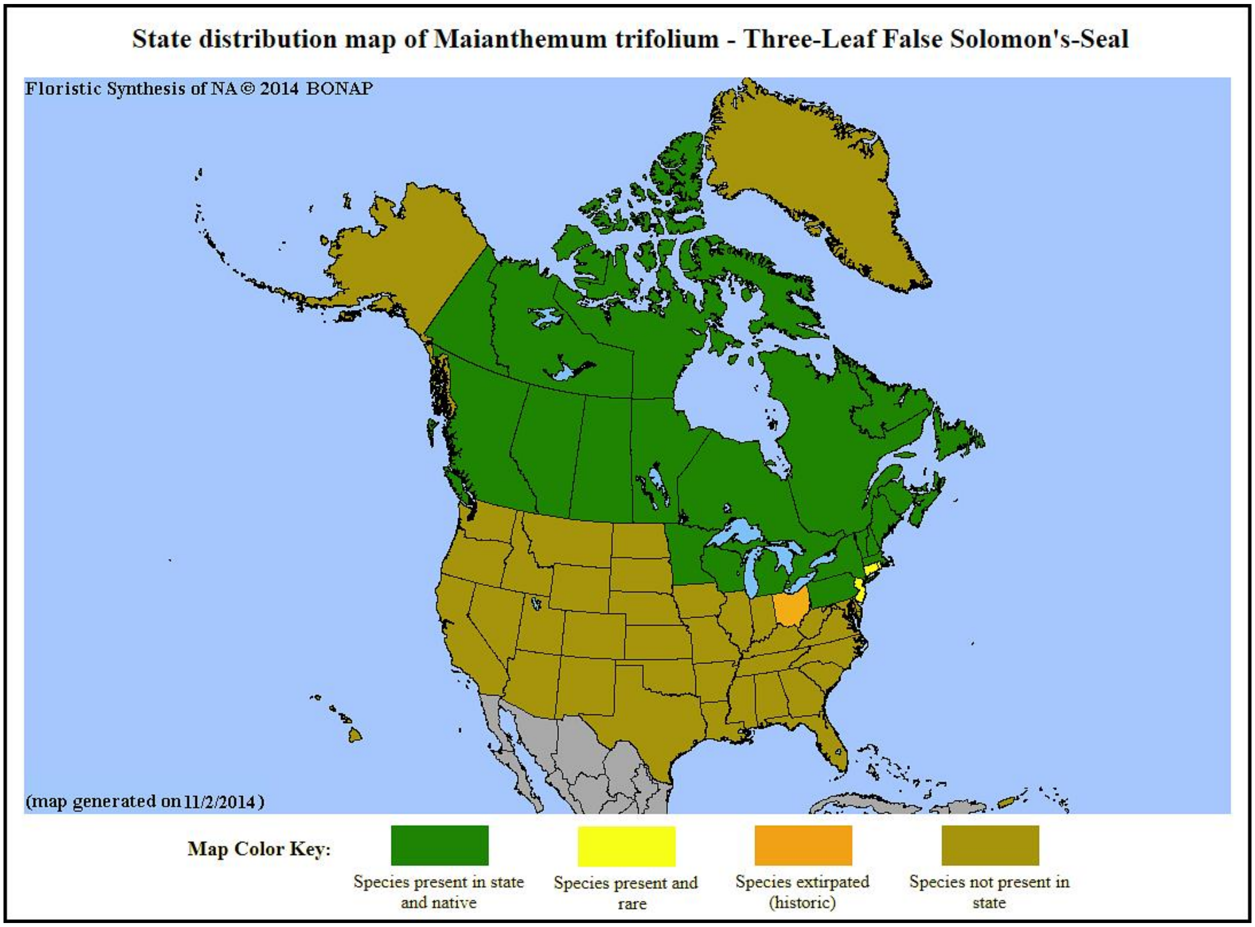
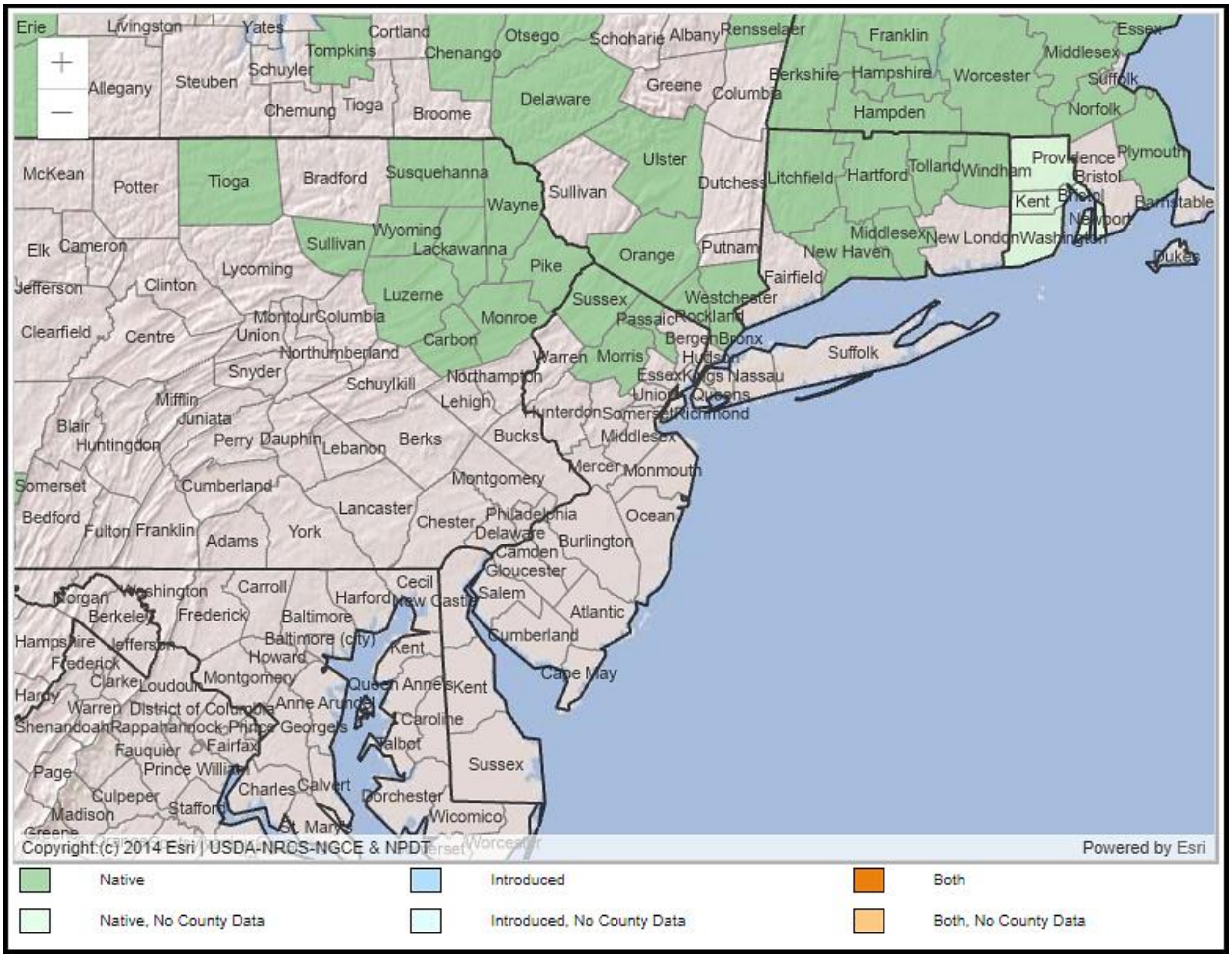


*Figure 1. Distribution of M. trifolium in North America, adapted from BONAP (Kartesz 2015).*

The USDA PLANTS Database (2025b) shows records of *Maianthemum trifolium* in three New Jersey counties: Morris, Passaic, and Sussex (Figure 2). The map reflects the current distribution of the species. A single collection from Bergen County has also been reported (Mid-Atlantic Herbaria 2025).



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|---|---|---|---|---|---|
| 🟩 | Native | 🟦 | Introduced | 🟧 | Both |
| ☐ | Native, No County Data | ☐ | Introduced, No County Data | 🟧 | Both, No County Data |

*Figure 2. County records of M. trifolium in New Jersey and vicinity (USDA NRCS 2025b).*

## Conservation Status

*Maianthemum trifolium* 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 2025). The map below (Figure 3) illustrates the conservation status of *M. trifolium*. The species is vulnerable (moderate risk of extinction) in one province and one state, imperiled (high risk of extinction) in one state, critically imperiled (very high risk of extinction) in two states, and likely extirpated in Ohio. *M. trifolium* is secure or apparently so throughout much of Canada and in several northern states, although the species has not been ranked in a number of the states where it occurs.

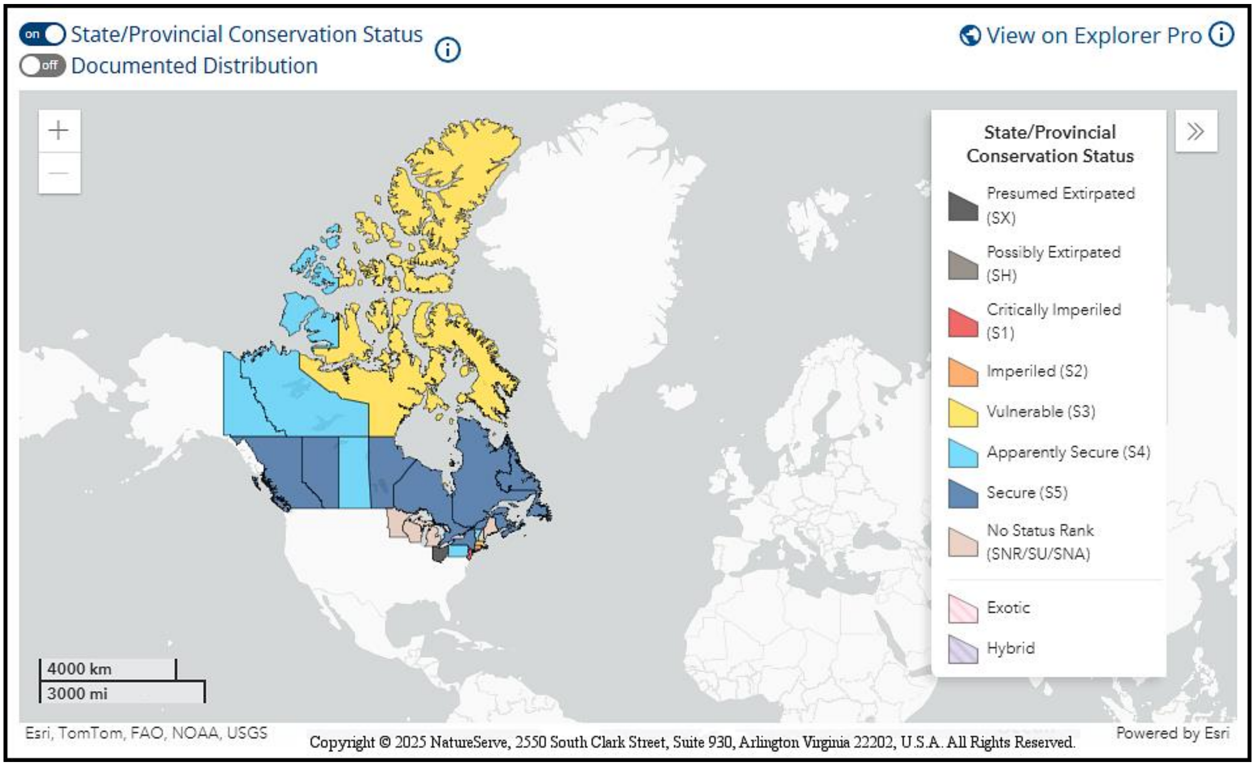

*Figure 3. Conservation status of M. trifolium in North America (NatureServe 2025).*

New Jersey is one of the states where *Maianthemum trifolium* is critically imperiled (NJNHP 2024). 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. *M. trifolium* 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 such as wetlands or coastal habitats, being listed does not currently provide broad statewide protection for the plants. Additional regional status codes assigned to Three-leaf False Solomon's-seal 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).

During the late 1800s and early 1900s *Maianthemum trifolium* was recorded in Sussex, Passaic, and Morris counties (Willis 1877, Britton 1889, Taylor 1915). The species maintained a presence in all three counties throughout the 20th century and continues to do so (Fables 1956, Snyder and Vivian 1981, Hough 1983, NJNHP 2024). Four extant occurrences are tracked by the Natural Heritage Program, including one that has been known since 1909 and two that were just found about a decade ago but may be rediscoveries of populations documented by Austin and Britton during the 1800s. There appears to be an additional occurrence that is not currently included in the state database (Anderson 2000, iNaturalist 2025).

## Threats

For one New Jersey population of *Maianthemum trifolium* that is situated in a Hemlock bog, potential changes to the community following the spread of the Wooly Adelgid (*Adelges tsugae*) were identified as a concern. Most other occurrences in the state appeared to be secure when they were last observed, although the dumping of trash was noted at the site of a colony that was part of a more extensive population (NJNHP 2024). While herbivory was not reported as a threat, it may take a toll on some occurrences in New Jersey. The leaves of *Maianthemum trifolium* have a high protein content and are readily digestible (Schaefer and Pruitt 1991). The species makes up a significant portion of the summer diet of Woodland Caribou (*Rangifer t. tarandus*) in Canada (Thompson et al. 2015) and it is also palatable to White-tailed Deer (*Odocoileus virginianus*) (Pellerin et al. 2006, Hilty 2020).

In other parts of the species' range, occurrences of *Maianthemum trifolium* can be threatened by habitat degradation that results from development, resource extraction, wetland drainage, and similar anthropogenic changes (PANHP 2019, Soteropoulos 2024). Some population losses in Massachusetts were attributed to habitat destruction (Bertin 2002), and a study in central Canada found that *M. trifolium* was less likely to be present in recently logged sites than it was in unlogged or formerly logged stands (Brumelis and Carleton 1989). Deep disturbances to the substrate such as those caused by heavy machinery can make it difficult for the species to regenerate. Hugron et al. (2020) ascribed the failure of *M. trifolium* to establish in a restored peatland to the methodology used to prepare the donor plant material—a mechanical process that broke the rhizomes into small pieces (under 2 cm in length). Although rhizome fragmentation is natural in the species, roots and buds form at the ends of the segments which are usually 5–20 cm long (LaFrankie 1985, 1986a). Less harm to populations is likely to result from disturbances that leave the belowground parts of *M. trifolium* intact. For example, no detrimental impacts to the species occurred when seasonal roads ("ice roads") were constructed over peatlands for use during the winter months, and in some instances clonal spread appeared to be promoted by the more open canopy conditions (Campbell and Bergeron 2012).

Mixed results have been reported following natural disturbances such as fires or flooding by beavers. Beaver activity has been known to both create and eliminate suitable habitat for *Maianthemum trifolium* (Beals 1965, NJNHP 2024). Burning sometimes induces rapid regeneration in *M. trifolium* but it can also cause populations to decline (Foster 1985, Guêné-Nanchen et al. 2022). Differences could be due to the intensity of burns and how far the fires extend into the substrate.

## Climate Change Vulnerability

Information from the references cited in this profile was used to evaluate the vulnerability of New Jersey's *Maianthemum trifolium* populations to climate change. The species was assigned 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) and the state climactic computations by Ring et al. (2013). Based on available data *M. trifolium* was assessed as Highly

Vulnerable, meaning that it is likely to experience a significant decrease in abundance or range extent throughout New Jersey by 2050. The same conclusion was reached when the species was evaluated in Pennsylvania (Schuette 2022).

*Maianthemum trifolium* reaches the southern limit of its range in New Jersey, where it is restricted to cold bogs in the northern part of the state (Snyder and Vivian 1981). Nearly a century ago, McVaugh (1935) noted a reduction in the abundance of *M. trifolium* and other plants occupying high-altitude habitats in New York. At present, temperatures are rising rapidly in New Jersey—with the increase being especially pronounced during the winter months—and changes in global circulation patterns are also resulting in atypical weather patterns and prolonged periods of drought (Hill et al. 2020). Since periods of exposure to low temperatures are critical to the development of *M. trifolium* plants during all life stages, its reproductive cycle is likely to be disrupted by unseasonable warm spells. A long running experiment to evaluate the effects of climate change in northern peatlands has shown that *Maianthemum trifolium* is one of the first species to decrease in response to warming. The direct impacts of rising temperatures and a concurrent increase in the growth of shrubs probably drive its decline (McPartland et al. 2020, Hanson et al. 2025). Warmer conditions and extended droughts are also likely to facilitate the establishment of invasive species in the habitats utilized by *M. trifolium* (Bellard et al. 2013, Salva and Bradley 2023).

## Management Summary and Recommendations

No immediate management needs have been identified for the *Maianthemum trifolium* populations in New Jersey. However, the Morris County population has not been monitored since 1990 and two other sites are in need of basic population assessments. Routine monitoring visits should focus on habitat quality. Although little can be done at the local level to minimize the impacts of climate change, some *M. trifolium* populations might benefit from management of shrub density or the removal of invasive plants.

One area where research could be beneficial is the exploration of relationships between *Maianthemum trifolium* and other species in the community. Competition with shrubby plants has been inferred from selected observations but not directly studied, and it would be useful to know whether light availability affects the species' level of sexual and vegetative reproduction. More information is required about the relationship between *M. trifolium* and the endophyte (*Phialocephala fortinii*) that was recovered from its roots, and the possibility of other fungal partners (or parasites) is also worthy of investigation. Conflicting reports regarding the impact of fire on *Maianthemum trifolium* populations underscore the need to determine how the species is affected by burns of varying frequency, seasonality, or intensity.

## Synonyms and Taxonomy

The accepted botanical name of the species is *Maianthemum trifolium* (L.) Sloboda. Orthographic variants, synonyms, and common names are listed below (ITIS 2025, POWO 2025, USDA NRCS 2025b). The subset of *Maianthemum* species that were formerly segregated in

*Smilacina* have been subject to numerous taxonomic revisions, which were reviewed by Galway (1945) and subsequently by LaFrankie (1986b). When LaFrankie incorporated *Smilacina* into *Maianthemum*, the intermediate characteristics of *Smilacina trifolia*/*Maianthemum trifolium* were a consideration.

### Botanical Synonyms

*Convallaria trifolia* L.
*Smilacina trifolia* (L.) Desf.
*Asteranthemum trifolium* (L.) Nieuwl.
*Tovaria trifolia* (L.) Neck. ex Baker
*Unifolium trifolium* (L.) Greene
*Vagnera pumila* Standl.
*Vagnera trifolia* (L.) Morong

### Common Names

Three-leaf False Solomon's-seal
Threeleaf False Lily-of-the-valley
Three-leaf Solomon's-plume

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