Waldsteinia fragarioides var. *fragarioides*

Barren-strawberry

Rosaceae

Barren Strawberry by Homer D. House

***Waldsteinia fragarioides* var. *fragarioides* Rare Plant Profile**

New Jersey Department of Environmental Protection
Division of Parks and Forestry
New Jersey Forest Service
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Introduction

Barren-strawberry is the common name for the imperiled New Jersey plant species *Waldsteinia fragarioides var. fragarioides*. The leaves of this species bear strong resemblance to the common strawberry *Fragaria virginiana,* which lends itself to *Waldsteinia's* descriptive name "*fragarioides*" (strawberry-like). The term "barren" refers to the fact that plant does not bear a sweet fruit like its namesake. There are some discrepancies among taxonomists regarding variants of the botanical name (further discussion on the topic can be found in the section 'Synonyms'). For clarity and brevity throughout this abstract the species will be referred to by either the full Latin name as listed on the New Jersey Rare Plants List: *Waldsteinia fragarioides var. fragarioides* (NJ NHP 2010), *W. fragarioides,* or simply as Barren-strawberry.

Barren Strawberry Flower by Ryan Hodnett (CC BY-SA)

Barren Strawberry Leaf by Ryan Hodnett (CC BY-SA)

Life History

Waldsteinia fragarioides var. *fragarioides* is a terrestrial, perennial, evergreen herb with bright yellow, 5-petaled flowers rising from leafless stems. Barren-strawberry blooms in early to late spring and can be found in flower across Northeastern & Northcentral North America from April to June. The trifoliate leaf, while suggestive of a strawberry (*Fragaria sp*.) possesses a less oval and more triangular form with each leaflet narrowing to the base forming an acute angle. The leaf of Barren-strawberry is known to persist through winter while the leaves of the *Fragaria* die back. The more noticeable characteristic difference is that *W. fragarioides* lacks the bright fleshy fruit of the common strawberry and produces seed in dry achenes (Peterson and McKenny 1968, MNDNR 2019).

Reproduction of *W. fragarioides,* much like species of *Fragaria,* is thought to be mainly vegetative (MNDNR 2019). However, the Barren-strawberry forms dense clonal colonies from creeping rhizomes underneath the soil as opposed to the stoloniferous above-ground runners of

the common strawberry (Minnesota Wildflowers 2019). While a rare plant, Barren-strawberry can still be considered locally abundant, however the genetic diversity within these colonies is low. This is due to the vegetative reproduction strategy it uses which is most likely a response to the plant's low seed production and the lack of a flavorful fruit that would promote greater seed dispersal. Barren-strawberry has been known to be autogamous (self-pollinating), also adding to the genetic bottleneck effect of the species (Hill 2003).

Pollinator Dynamics

Another possible factor in its low genetic diversity is that there are currently no specific known pollinators of *W. fragarioides* (MNDNR 2019) although it has been established that most of the other species in the genus *Waldsteinia* are pollinated by insects (Robertson 1974). More recent studies on pollinator syndromes (preferential pollination by flower color and shape) show that many species of true flies (order Diptera) and bees (order Hymenoptera) have an affinity for yellow flowers such as *W. fragarioides*. The flat open or "dish-like" shape of the Barren-strawberry bloom is more conducive to fly pollination, as bees, in general, prefer a tubular shape containing more nectar (Glover 2014). Myophily (fly pollination) may be the most likely method by which *W. fragarioides* can at times, successfully cross-pollinate.

Seed Dispersal

The seeds of Barren-strawberry occur singly in a dry achene. The dispersal mechanism of this fruit is unknown but there is speculation that ants may transport the achenes, and that some birds and small mammals may consume the fruit and disperse the seed after digestion (Robertson 1974).

Habitat

In Eastern North America the Barren-strawberry "occurs in a wide variety of habitats, including coniferous, deciduous, and mixed forest types in both moist and dry sandy woods, barrens, thickets and clearings, steep mountain talus slopes, rocky bluffs, and in alluvial substrates along stream banks" (Nature Serve 2019). In New Jersey, *W. fragarioides* is said to occur in "moist, rich woods and pastures" (Walz et al. 2018). According to the NJ Natural Heritage Program's Biotics database (2019) all extant populations occur in wooded areas in the northwest section of the state. With one patchy population growing on a dry, slate outcrop of a wooded hillside, the remaining occurrences are associated with limestone geology and grow either along tops of ridges or at the base. One population occurring on a wooded limestone bluff has said to be associated with the tree species *Acer saccharinum* (Silver Maple), *Celtis occidentalis* (Hackberry), and *Quercus sp.* (Oaks). Several of the occurrences are noted growing along small woodland streams. One of the state's large populations was discovered in a drier portion of a deciduous wooded wetland with the following tree species associates: *Acer saccharum* (Sugar Maple), *Carya ovata* (Shagbark Hickory), and *Carpinus caroliniana,* (Musclewood).

Wetland Indicator Status

Barren-strawberry is classified as an Obligate Upland (UPL) species in the state of New Jersey (Walz et al. 2018) meaning that the probability of the species occurring in a wetland is very low. (USDA NRCS 2019)

USDA Plants Code

WAFRF2; NJ accepted USDA Plants Code: WAFRF (synonym *Waldsteinia fragarioides* (Michx.) Tratt. ssp. *fragarioides* (Walz et al. 2018)).

Coefficient of Conservatism (Walz et al., 2018)

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

Distribution and Range

The map below shows a general view of the range and state rarity status of Barren-strawberry.

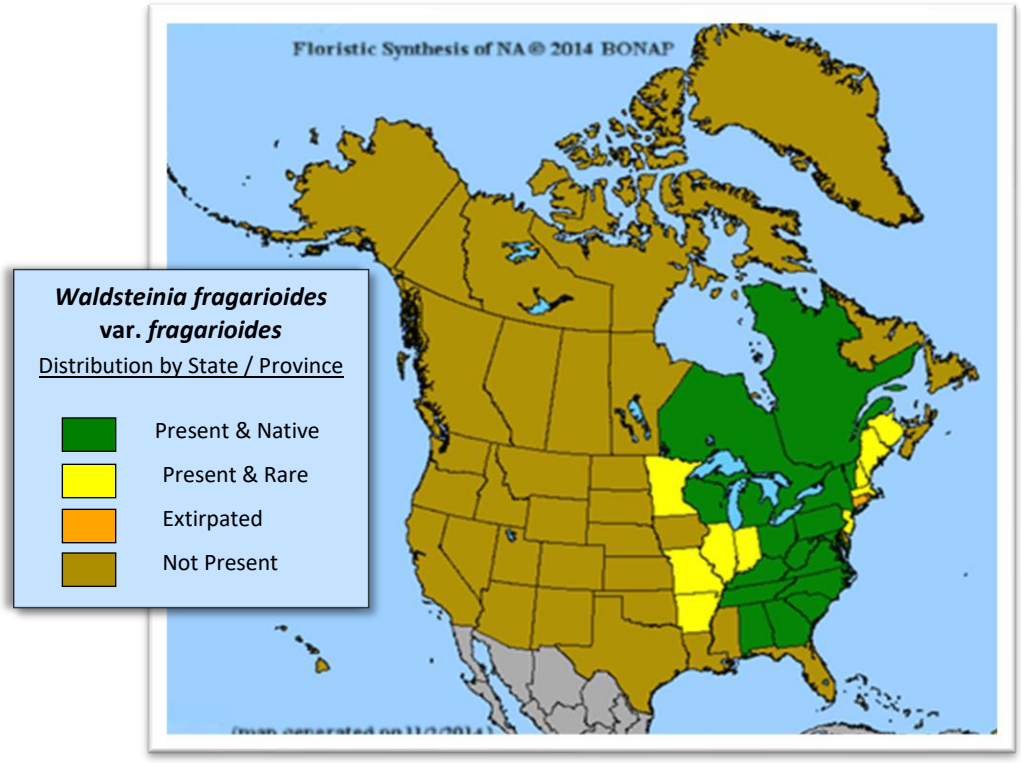

Figure 1 North American State Distribution of Barren-strawberry; adapted from BONAP (Kartesz 2015)

Below is a county level distribution map focusing on New Jersey and contiguous counties of the surrounding states. A closer look at the NJ county level distribution and rarity status of the species as documented in the Biotics database will be discussed in the following section on "Conservation Status".

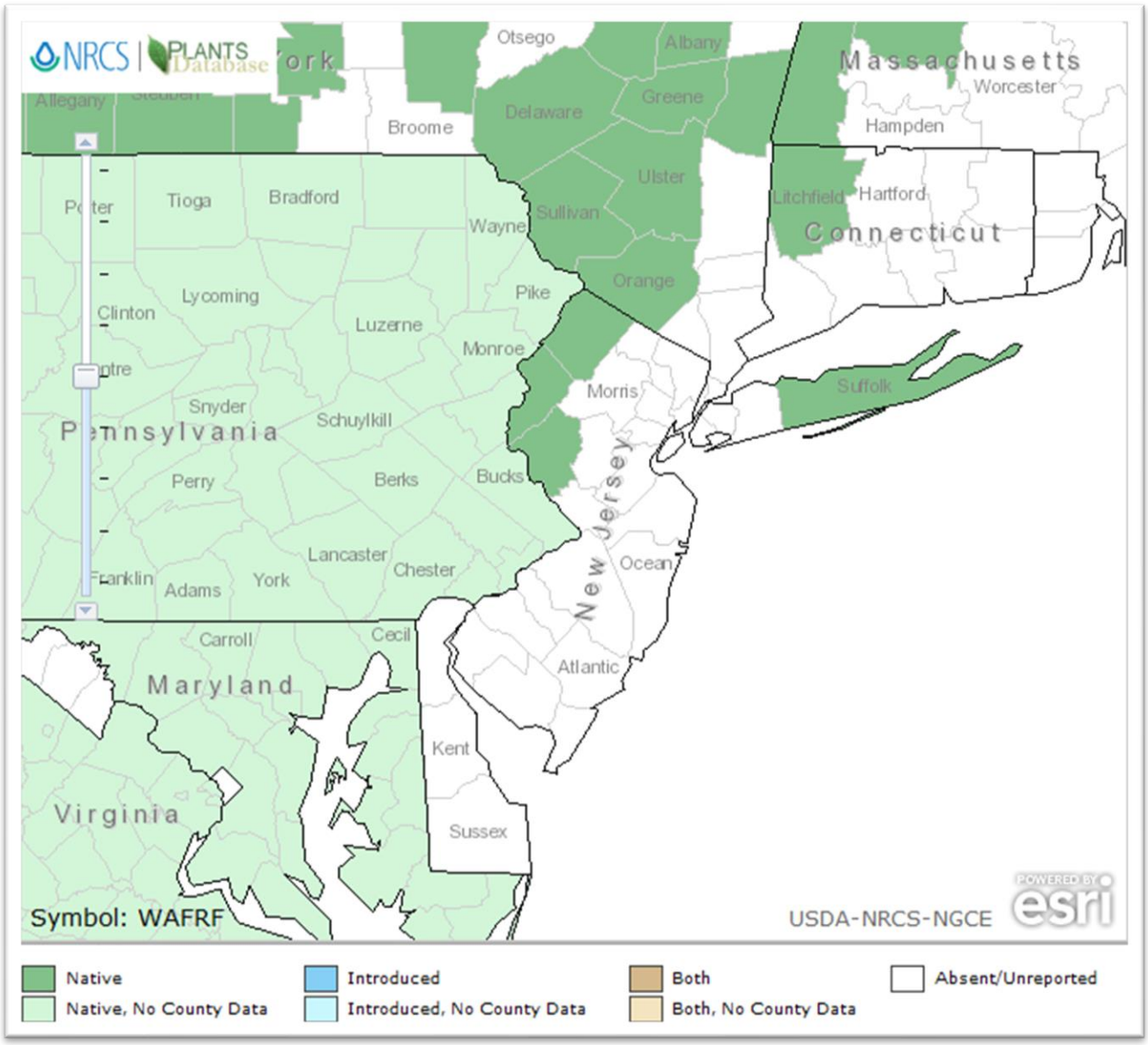

Figure 2. NJ County Distribution of W. fragarioides (adapted from USDA, NRCS 2019)

Conservation Status

W. fragarioides is considered globally stable and is currently listed as G5T5 meaning that worldwide, the species/subspecies (T rank refers to subspecies) is "secure: common; widespread

and abundant" (NatureServe 2019). "[Although] demonstrably secure globally...it may be quite rare in parts of its range, especially at the periphery" (NJ NHP 2010). That explains how it is possible for a species to be threatened or critically imperiled at the state level while at the same time globally secure.

The NJ Natural Heritage Program (2010) lists Barren-strawberry as S2, indicating that the species is "imperiled in New Jersey because of rarity (6 to 20 occurrences). Historically many of these elements may have been more frequent but are now known from very few extant occurrences, primarily because of habitat destruction. Diligent searching may yield additional occurrences". The code HL indicates that the species is "protected by the Highlands Water Protection and Planning Act within the jurisdiction of the Highlands Preservation Area" (NJ NHP 2010) although all known populations occur the Ridge and Valley region of New Jersey (NJ NHP 2019).

In New Jersey only six known extant populations of *W. fragarioides* are documented in the NJ NHP Biotics database; with one occurrence in Warren County (near the northern border) and 5 in Sussex. Four historic occurrences (discovered at some point in the past but now no longer in existence) were also found in the Ridge and Valley, with one in Warren and three in Sussex County (NJ NHP 2019).

Threats

Populations of *W. fragarioides* are threatened by numerous anthropogenic disturbances. Clearcutting and other practices associated with forest management like the construction of logging roads are major threats to the species. Also detrimental to populations of Barren-strawberry is land development, habitat fragmentation, and the aerial application of herbicides. Additional large-scale threats include "flooding by impoundment, construction, and quarrying." Man-made threats at a smaller scale, like motorized recreational vehicle use and even horseback riding can do significant harm to populations of *W. fragarioides.* Both activities crush vegetation and can compact the soil, damaging the shallow rhizomes of the Barren-strawberry, destroying its main form of reproduction (Hill 2003).

The introduction of exotic plant species that can aggressively naturalize in a variety of habitats poses an enormous threat to reproductively slow species like Barren-strawberry. *Lonicera japonica* (Japanese honeysuckle) for example, is an invasive climbing liana (a non-woody vine) that can root along the ground in a dense tangle, crowding out the pre-existing herb layer. If a tree or shrub is in proximity, *Lonicera* will twine up to the top of the plant, spread out, and eventually block sunlight to everything below it. Even shade tolerant ground cover herbs like *W. fragarioides* will eventually be out competed with this tactic (Hill 2003).

Management Summary and Recommendations

Hill (2003) plainly states that *Waldsteinia fragarioides* var. *fragarioides* will only successfully persist if we "[m]aintain the habitat in which it grows..[as its]..apparent lack of success in

establishing many new colonies from seed suggests a very limited possibility for spread...There appears to be little chance of natural colonization of new habitat by this plant...and so the long-term viability of this rare plant appears to depend entirely on the protection and management of existing populations through human intervention."

Currently there is no scientific information regarding the specific management needs for the species, but care can be taken to lessen impact damage. Forestry activity is the biggest threat to populations of Barren-strawberry and therefore site-specific management plans should be well planned out by forestry managers, environmental impact specialists, and both plant and wildlife ecologists before conducting any tree removal in areas containing *W. fragarioides* and other species of concern. Buffer zones that can be extended out from an established minimum distance from threatened populations should be created considering the different factors that create suitable habitat for rare species in an area (NJBFM 1995).

Large-scale construction practices must follow suit, with specialized buffer zones. Aerial applications of herbicides should be kept to a minimum and applied with precision on windless days. Buffer zones for these must be strategically calculated with flight path planning or scaled down to a ground control of pest species like Japanese Honeysuckle. Rules against destructive recreational activities like ATV riding need to be enforced in and around occurrences either by monitoring which may be cost prohibitive, or by more passive methods like redirecting trails that allow vehicle access away from areas with known *W. fragarioides* populations. Posting signage that very generally explains the need for lower levels of human disturbance in the area can educate the public and at the same time protect critical species.

In addition to avoiding or lessening impact of certain human activity in the vicinity of Barren-strawberry, more proactive measures could possibly be implemented to encourage the growth of the species. There is some evidence that *W. fragarioides* may benefit from fire. An experimental burn site study in a Canadian boreal forest showed preliminary increase in the ground cover of *W. fragarioides* due to nutrient availability resulting from changes in the chemistry of the burnt soil (Lynham et al. 1998). However, the role of fire in the complete life history of *W. fragarioides* is poorly understood and any use of fire as a management tool should probably be infrequent since the landscape where the species is found would not have burned regularly on its own (MNDNR 2019).

Further studies can be conducted in states where the populations of *W. fragarioides* are considered stable and abundant (such as New York and Vermont) to quantify both the short and long-term effects of prescribed burning on the species. Also, in managed forested sites, data should be gathered to evaluate the effects of clear cutting versus selective harvest forestry where Barren-strawberry occurs. Data of that nature would be beneficial for states like New Jersey that implement selective timber harvesting to ensure seedling regeneration in old forests.

Synonyms

According to NatureServe (2019) the Flora of North America does not recognize distinctions between subspecies and variations of Barren-strawberry and classifies them all as *Waldsteinia*

fragarioides. Many leading taxonomic entities have discrepancies over whether listed subspecies of *W. fragarioides* are unique or synonyms. Three of these agencies: the ITIS Report (2019), The Plant List (2013), and the USDA Plants Database (2019) have varying lists of the botanical names of synonyms and subspecies of *W. fragarioides* compiled from their databases. Below is a listing of all current synonyms.

Botanical Name	**Common Names**
*Waldsteinia fragarioi*des (Michx.) Tratt.var. *fragarioides*	Barren-strawberry Barren-Strawberry Alpine Barren-strawberry Appalachian Barren-strawberry

Botanical Synonyms

Waldsteinia fragarioides (Michx.) Tratt.
Waldsteinia fragarioides. (Michx.) Tratt. ssp. *fragarioides*
Waldsteinia doniana Tratt.
Bossekia fragarioides (Michx.) Raf.
Comaropsis fragarioides (Michx.) DC.
Dalibarda fragarioides Michx.
Geum fragarioides (Michx.) Smedmark
Waldsteinia fragarioides (Michx.) Tratt. ssp. *doniana* (Tratt.) Teppner
Waldsteinia fragarioides (Michx.) Tratt. var. *parviflora* (Small) Fernald
Waldsteinia parviflora Small

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