Asplenium montanum Willd.

Mountain Spleenwort

Aspleniaceae

(Montgomery and Fairbrothers, 1992); © Rutgers University Press

***Asplenium montanum* Rare Plant Profile**

New Jersey Department of Environmental Protection
Division of Parks and Forestry
New Jersey Forest Service
Office of Natural Lands Management
New Jersey Natural Heritage Program

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Life History

Asplenium montanum is a diminutive, pale blue/green fern of non-calcareous rock ledges, cliffs, and balds. *A. montanum* is primarily Appalachian in its distribution (Flora of North America Vol. 2, 2019). Roots are scaly and spread prolifically; dense clusters can easily be mistaken for a multistemmed individual. The stipe is glabrous and unscaled. Stipe coloration is dark brown close to the roots, and green approaching the blade and continuing throughout the rachis. Blade is roughly deltoid, egg to lance shaped, 7-10 cm wide at the base, tapering toward the distal end and contains 5-12 alternate pairs of pinnae. Leaves are alternate, coarsely toothed, nearly sessile, and pinnate to bipinnate with as many as 5 alternately branched pinnules per pinna (Gleason & Cronquist, 1991). The top surface of leaves has also been described as glossy (Wagner, 1953). While known to be evergreen, *A. montanum* frequently browns and withers following the first frost, making winter identification difficult. The best time of year to find and identify *A. montanum* is between May and October (New York Natural Heritage Program, 2019).

Reticulate Evolution Among Appalachian *Asplenium*

A. montanum is a member of the Appalachian *Asplenium* complex, a result of reticulate evolution (Wagner, 1953). Reticulate evolution is a process in which two recently split lineages partially merge, resulting in hybrid speciation and a phylogeny that resembles a complex web rather than a tree. The complex is composed of 8 distinct entities, some of which are viable and some of which are sterile hybrids. *A. montanum* occupies an "extreme" end of the three sided complex, within which all viable and non-viable entities exist. The graphic below illustrates the relationships between different members of the Appalachian *Asplenium* complex. *A. montanum* is represented by the letter "M" in the bottom right corner of the diagram, *A. platyneuron* is represented by the letter "P" on the bottom left of the diagram, and *A. rhizophyllum* is represented by the letter "R" on the top of the diagram. These three species are on the extreme ends of the complex. Multi-letter combinations represent hybrids. For example, "PM" is *A. bradleyi,* a hybrid of *A. platyneuron* and *A. montanum*. Entities "inside" the diagram are the result of hybridization by extreme members and subsequent backcrossing of the hybrid with an extreme member or the product of two hybrids. For example, *A. gravesii* is the product of *A. bradleyi* and *A. pinnatifidum*, both of which are hybrids themselves (Wagner, 1953). *Asplenium x wherryi* is an additional hybrid borne of a backcross between *A. montanum* and *A. bradleyi*, first discovered in New Jersey by Edgar T. Wherry in 1935, but not formerly recognized until the 1960s (Wherry, 1935; Wagner, 1956; Smith et. al, 1961). Unfortunately, this occurrence in New Jersey is presumed destroyed and the habitat is now overgrown with *Vitis* (Wagner, 1956; Montgomery and Fairbrothers, 1992). Another occurrence could exist in northwestern Morris County as both parent species occur in the same area (Montgomery and Fairbrothers, 1992).

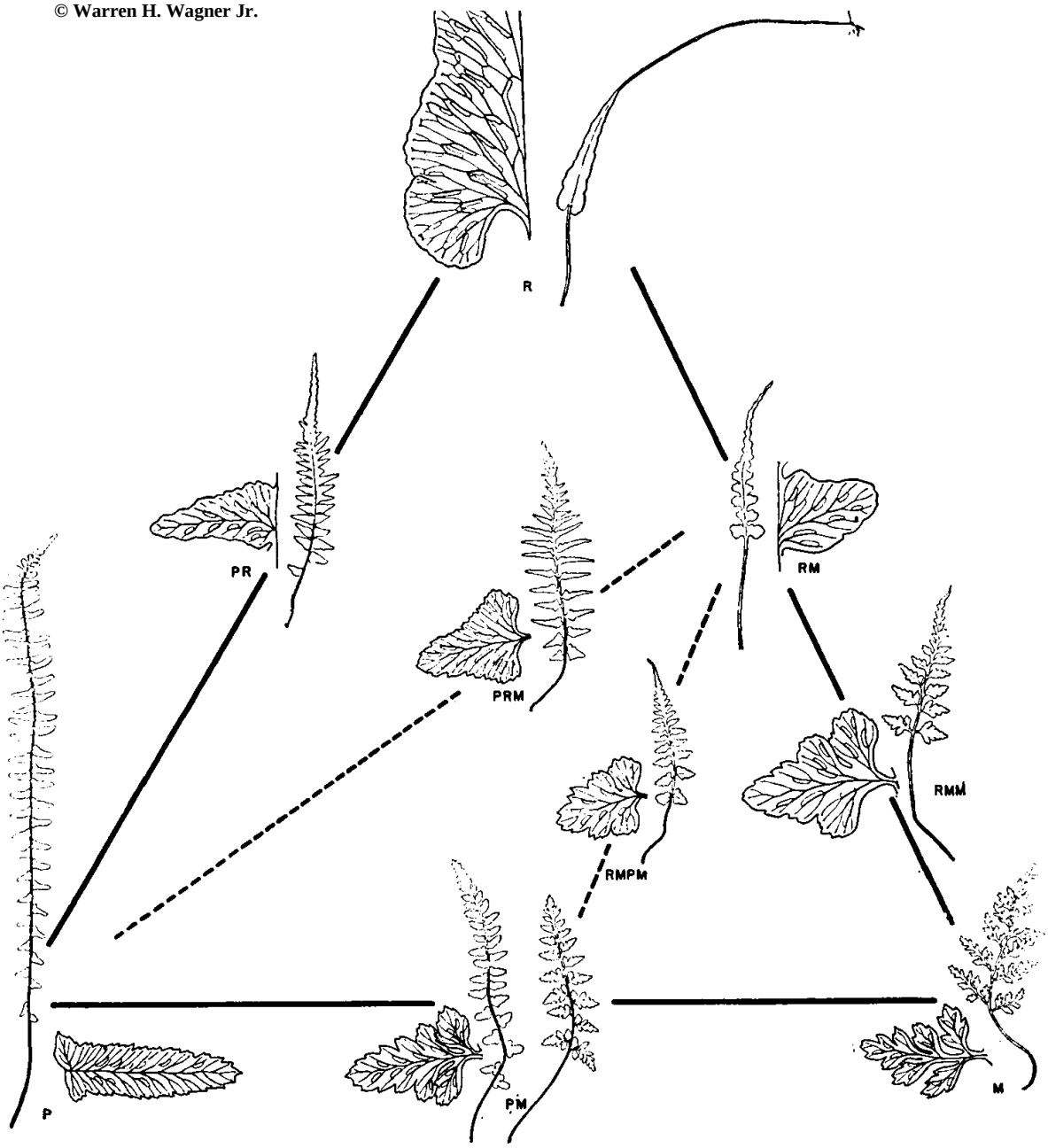


FIG. 1. Concept of relationships in the Appalachian Aspleniums. R. *Asplenium rhizophyllum;* P. *A. platyneuron;* M. *A. montanum;* PR. *A. ebenoides;* RM. *A. pinnatifidum;* PM. *A. bradleyi* (frond on left, Frederick Co., Va., *Gilbert 250;* frond on right, Madison Co., Mo., *Russell*); RMM. *A. trudellii;* RMPM. *A. gravesii;* PRM. *A. kentuckiense.*

(Wagner, 1953)

Pollinator Dynamics

No pollinator dynamics as *A. montanum* does not produce flowers.

Seed Dispersal

A. montanum produces spores, with approximately 64 spores in each sporangium (Flora of North America Vol. 2, 2019). However, little information on spore dispersal strategy exists.

Habitat

A. montanum is a specialist of partially shaded, damp crevices of non-calcareous rock outcroppings, cliffs, balds, ledges, and talus slopes (Flora of North America Vol. 2, 2019; Gleason & Cronquist, 1991). *A.* montanum occupies the trace amounts of acidic soil found in crevices of conglomerate, sandstone, gneiss, or shale cliffs (Cobb et al, 2005). Populations in New Jersey are entirely confined to sheer rock faces and steep, talus slopes.

More often than not, *A. montanum* is the sole resident of its cliff face habitat. However, associated species include *Betula populifolia, Cystopteris fragilis, Danthonia compressa, Deschampsia cespitosa, Kalmia latifolia, Quercus montana, Quercus rubra,* and *Tsuga canadensis* (New York Natural Heritage Program, 2019). Occasionally, it may occur alongside *Asplenium bradleyi* and *Asplenium pinnatifidum* (Flora of North America Vol. 2, 2019). In New Jersey, *A. montanum* occurs alongside *Arabidopsis lyrata, Prunus serotina, and Betula populifolia* (New Jersey Natural Heritage Program, 2019).

Recorded Occurrences for New Jersey

Natural Heritage Biotics Database Occurrences:

There are only 4 recorded occurrences in the Natural Heritage Biotics Database; 3 of the occurrences are from Warren County and one is from Morris County. However, only a single occurrence in Warren County, found along cliffs and slopes of the Kittatinny Ridge, has been confirmed recently in 2017 (New Jersey Natural Heritage Program, 2019). The Biotics Database may be incomplete for more common species (S2 and S3) and additional occurrence information may be found in herbaria or other sources.

Montgomery and Fairbrothers (1992) show at least 7 occurrences in northern New Jersey across Warren, Sussex, Morris, Union, and Passaic counties and describe the habitat as cliffs and non-calcareous rocks.

Wetland Indicator Status

A. montanum is classified as an upland (UPL) species (USDA, 2019; New England Wildflower Society, 2019).

USDA Plants Code

ASMO2

"Each symbol is composed of the first two letters of the genus+first two letters of the species+first letter of the terminal infraspecific name+tiebreaking number (if needed)" (USDA, 2019).

https://plants.usda.gov/core/profile?symbol=CACO17

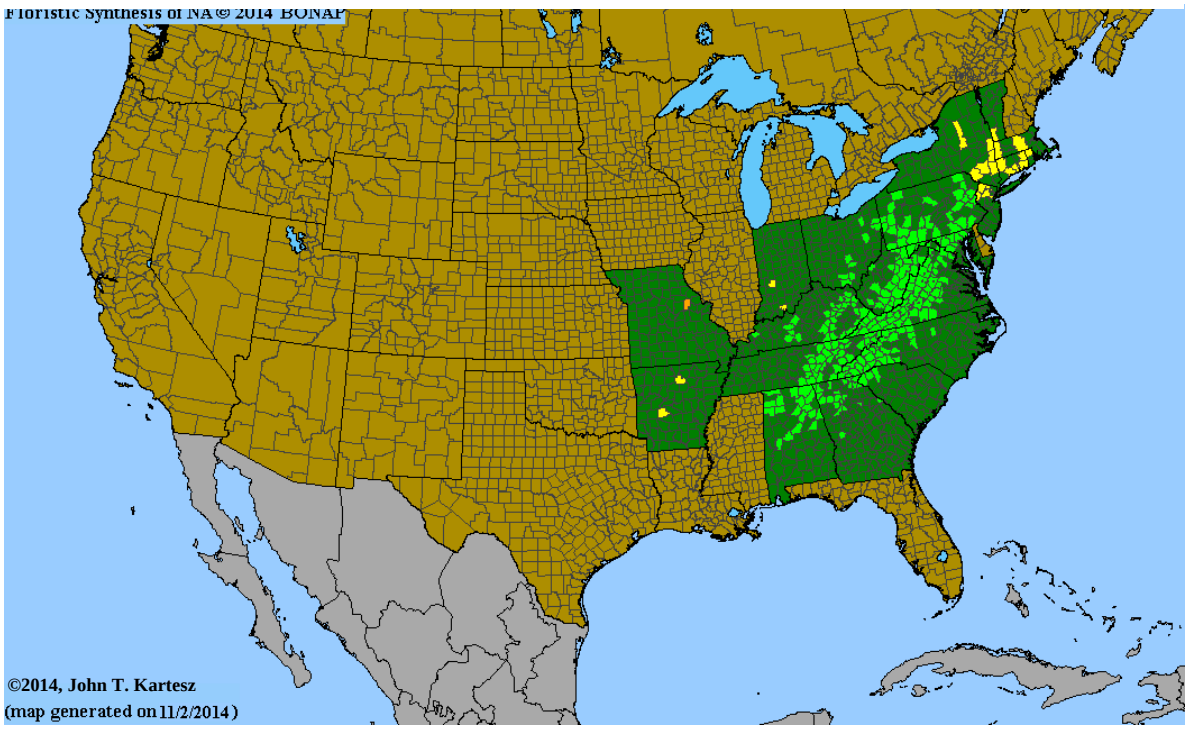
Coefficient of Conservatism (Walz et al. 2018)

CoC=8; Native with a narrow range of ecological tolerances and typically associated with a stable community.

Distribution and Range

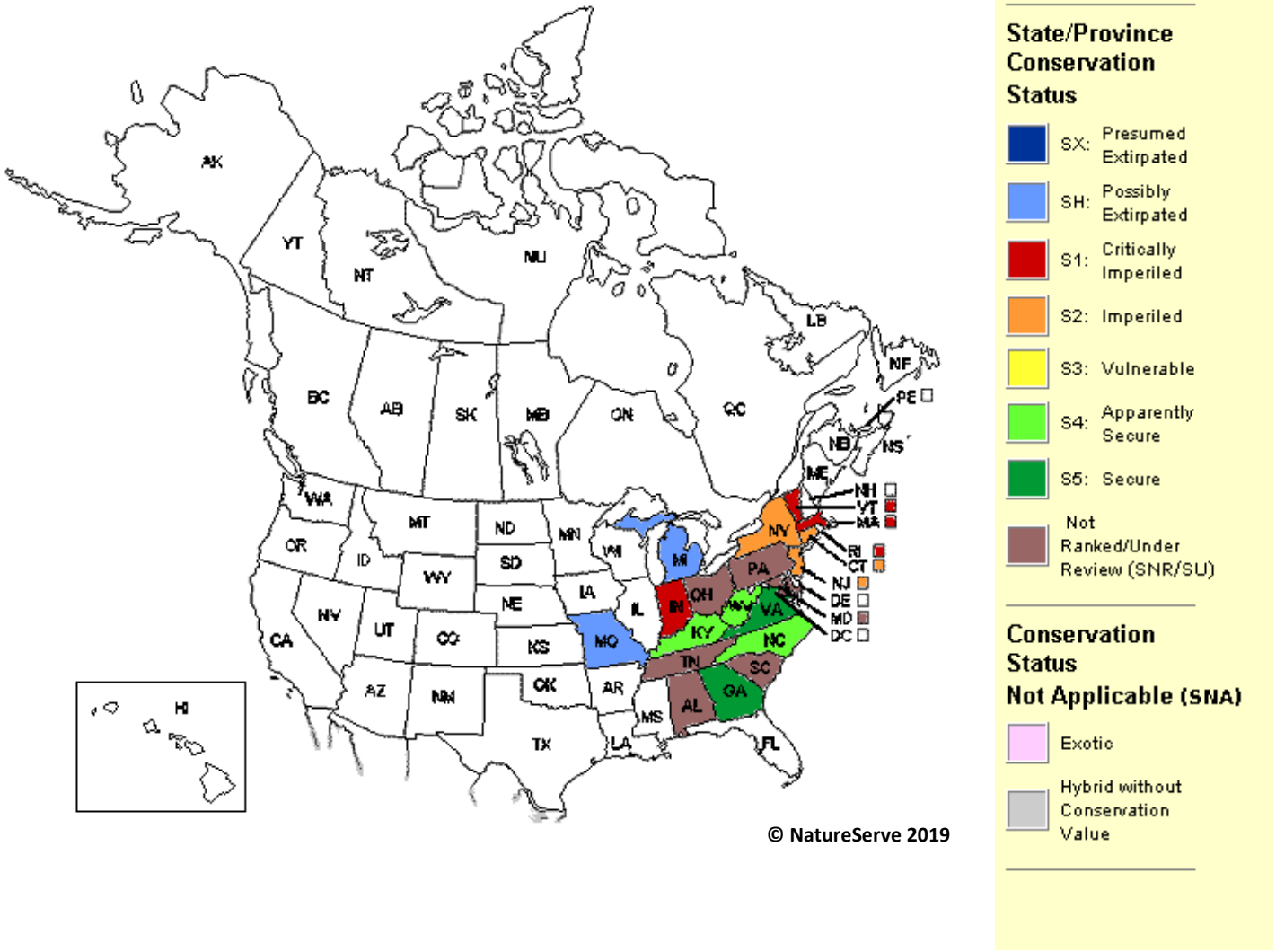
A. montanum is a species found primarily in the Appalachian Mountains, with an extant range stretching from northern Alabama to southern Vermont with critically imperiled or extirpated outlier occurrences in Indiana, Michigan, and Missouri. *A. montanum*'s conservation rank in each state within its range is as follows: Alabama (SNR), Connecticut (S2S3), Georgia (S5), Indiana (S1), Kentucky (S4S5), Maryland (SNR), Massachusetts (S1), Michigan (SH), Missouri (SH), New Jersey (S2), New York (S2S3), North Carolina (S4), Ohio (SNR), Pennsylvania (SNR), Rhode Island (S1), South Carolina (SNR), Tennessee (SNR), Vermont (S1), Virginia (S5), West Virginia (S4) (NatureServe, 2019; Kartesz, 2015).

Geographic Range of *Asplenium montanum* (Kartesz, 2015)



County Color Key: Native, not rare | Native, rare | Native, adventive | Extirpated | Extinct | Exotic | Noxious weed | Eradicated | Waif | Questionable presence

***Asplenium montanum* Distribution Map with S Ranks (NatureServe, 2019)**



Conservation Status

Status for New Jersey

***Asplenium montanum* (S2)** (NatureServe, 2019; New Jersey Natural Heritage Program, 2019) 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.

Global Status

G5: Demonstrably secure globally; although it may be quite rare in parts of its range, especially at the periphery.

Threats

The fairly remote and rugged habitat preferences of *A. montanum* shield it from most human threats. However, recreational activities such as rock climbing and bouldering may negatively

impact *A. montanum.* Rock climbing is rapidly increasing in popularity. In the US, it's estimated that 1,500 people a day are trying rock climbing for the first time (Noble, 2014) and it's possible that lightly trafficked climbing routes could soon be overwhelmed by a higher than usual number of climbers. A multitude of studies across a wide variety of locales have examined the negative effects of climbing on habitat, species composition, density, and diversity on rock faces and boulders (McMillan & Larson, 2002; Clark & Hessl, 2015; Holzman, 2013; Tessler & Clark, 2016). Most studies found a significant difference in plant diversity between climbed and unclimbed habitat. A study conducted on the Niagara escarpment in Southern Ontario showed that vascular plant density was significantly lower on climbed sections of the plateau when compared to unclimbed sections (McMillan & Larson, 2002). Furthermore, the same study showed a massive increase in invasive plant species in climbed quadrats versus unclimbed quadrats (McMillan & Larson, 2002). Another, often ignored, effect of rock climbing and bouldering involves the use of chalk. Many cliff obligate plants, like *A. montanum,* have a pH preference. Chalk has the potential to alter soil and surface pH within cracks and ledges that often serve as refugia for sensitive plant species like *A. montanum*. While there has been little research done on the effects of climbing chalk on vascular plant communities on cliffs, a preliminary study suggests that chalk may have a positive impact on the presence of algae, but a negative impact on the presence of moss (Pereira, 2005).

Another threat, mentioned above, is that of invasive species. Trees like *Ailanthus altissima* are capable of establishing and thriving in a wide variety of habitats and substrate, including sheer cliffs and ledges (Fryer, 2010). While it is mainly known to invade calcareous soils and rocks, studies have shown that *Ailanthus altissima* will establish and grow in soil with pH as low as 4.1 (Plass, 1975). *Ailanthus altissima* quickly forms dense stands and has the potential to crowd and outcompete *A. montanum.*

Management Summary and Recommendations

Due to the small, but significant impacts recreational climbing can have on cliff plant communities, it may be necessary to limit access in areas known to harbor *A. montanum* occurrences. The presence of invasive species should also be monitored and, if necessary, removed from *A. montanum* habitat.

Additional Information

Research Suggestions:

Surveying for more occurrences seems promising. Plenty of suitable habitat exists for this species in New Jersey; it's likely that many more occurrences exist along the Kittatinny Ridge and potentially on the exposed cliffs and outcroppings of the Highlands Region.

Any information for historic occurrences that is not yet in Biotics should be mapped and used to inform future field surveys.

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