

*Conservation Assessment
for
Creeping snowberry (Gaultheria hispidula)*



Photo; Mike Hays

USDA Forest Service, Eastern Region

Prepared by:
Michael Hays, Botanist
Allegheny National Forest
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This document is undergoing peer review, comments welcome.

This Conservation Assessment was prepared to compile the published and unpublished information on the subject taxon or community; or this document was prepared by another organization and provides information to serve as a Conservation Assessment for the Eastern Region of the Forest Service. It does not represent a management decision by the U.S. Forest Service. Though the best scientific information available was used and subject experts were consulted in preparation of this document, it is expected that new information will arise. In the spirit of continuous learning and adaptive management, if you have information that will assist in conserving the subject taxon, please contact the Eastern Region of the Forest Service Threatened and Endangered Species Program at 310 Wisconsin Avenue, Suite 580 Milwaukee, Wisconsin 53203.

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SUMMARY

This Conservation Assessment provides a review of known information regarding the distribution, habitat, ecology and population biology of creeping snowberry (*Gaultheria hispidula*) within its range. Special emphasis is given to Pennsylvania and in particular the Allegheny National Forest, which is the only Region 9 Forest that classifies it as a sensitive species. The range of this species is broad, extending from the east coast of North America, almost to the west coast. Most occurrences are in Canada and the northern United States, where it can be common in some of the Lake States and New England. It is however, very uncommon or rare in states bordering the southern part of its range, including Pennsylvania. Throughout this range, it is found in bogs or open swamp habitats, often on hummocky ground in association with Sphagnum moss.

The Pennsylvania Natural Diversity Inventory (PNDI) records indicate that there are a total of 69 occurrences of *Gaultheria hispidula* in the state (Firestone 2001). Of these, 40 are known to be extant and 29 are historic. There are 31 extant records from the east part of the state and 9 from the west. Of the 29 historic records, 24 are in the east and 5 are from the west. This information illustrates the importance of the western populations to the overall conservation of creeping snowberry across the state.

The rarity of this species is attributed to several factors. The most significant natural factor is the narrow hydrologic conditions that place limitations on available habitat. There have been several threats to the survival of this species including habitat alteration through logging, agricultural uses and railroad construction. More recent significant threats include recreational use of habitat, development, invasion of noxious weed species and possibly herbivory.

There is a need to monitor known sites of occurrence and survey suitable habitats to obtain necessary baseline information for the management of this species. Specific topics of research that may enhance understanding of distribution, life history, habitat requirements, threats and viability may include studies in soil analysis, hydrologic conditions, light regimes and community structure.

INTRODUCTION/OBJECTIVES

The National Forest Management Act and U.S. Forest Service policy require that Forest Service lands be managed to maintain viable populations of all native plant and animal species. A viable population is one that has the estimated number and distribution of reproductive individuals to ensure the continued existence of the species throughout its range within a given planning area (FSM 2670.5.22). In addition to those species listed as threatened or endangered under the Endangered Species Act, or that are candidates for such listing; the Forest Service has recognized the need to implement special management direction for other rare species on the lands it administers. Such species may be designated as sensitive by the Regional Forester. The objectives of management for such species are to ensure their continued viability throughout their range on National

Forest lands, and to ensure that they do not become threatened or endangered because of Forest Service actions (FSM 2670.22).

The Eastern Region (R9) of the Forest Service updated its Sensitive Species list on February 29, 2000. Part of that process included identification of priority species for conservation assessments and strategies. *Gaultheria hispidula* is included on the R9 list for the ANF and is one of the species requiring a conservation assessment.

The objectives of this document are to review and compile currently known information on the biology, status and distribution of *Gaultheria hispidula* across its range, particularly on the ANF in Pennsylvania and to identify the information needed to eventually develop a strategy to conserve the species. This is an administrative study only and does not include management direction or management commitment.

NOMENCLATURE AND TAXONOMY

Scientific name: *Gaultheria hispidula* (L.) Muhl.ex Bigelow

Full bibliographic citation: Cat. Pl. Amer. Sept., ed. 2, 44. 1818.

Pertinent synonyms: *Chiogenes hispidula* (L.) Torr. & A. Gray.

Common name(s): Creeping snowberry, moxie, moxieplum, pearlberry, tea berry, maiden hair berry, capillaire.

Taxon codes: PDERIOF010 (NatureServe)

Size of genus: There are probably at least 150 species in North America, South America, east and southeast Asia and Australia. Most species occur in the mountains of South America, while 24 species are recognized in North America (Gleason 1952).

Family name: Ericaceae Juss. Includes approximately 1350 species in about 100 genera (Watson and Dallwitz 1992).

Pertinent family synonyms: *Gaultheria* is the tribe Andromedeae (G. Don) Klotzsch, of the subfamily Vaccinioideae (D. Don) Endl.. These taxa have been treated at the familial level as the Andromedaceae (Endl.) DC. Ex Schnizl. and the Vacciniaceae DC. Ex Gray.

Common name of family: Heath family.

Major plant group: *Magnoliopsida* (Dicotyledons).

PRESENT LEGAL OR OTHER FORMAL STATUS

U.S. Fish and Wildlife Service: none

U.S. Forest Service (Region 9): Regional Forester Sensitive

Definition: The Regional Forester has identified it as a species for which viability is a concern as evidenced by: a) significant current or predicted downward trends in population numbers or density, and or b) significant current or predicted downward trends in habitat capability that would reduce its existing distribution (FSM 2670.5.19).

Gaultheria hispidula is also a Regional Forester Sensitive species in Region 1 for its occurrence on the Idaho Panhandle National Forest in northern Idaho and for Region 6, where it is suspected on the Colville National Forest in Washington (Ahrensleger 2001).

NatureServe

Global Conservation Status Rank: G5

Definition of G5: Secure – Common, widespread and abundant globally (although it may be rare in parts of its range, particularly on the periphery). Not vulnerable in most of its range. Typically with considerably more than 100 occurrences and more than 10,000 individuals. (All ranking definitions are from NatureServe 2001).

National Conservation Rank (United States): N? (31 July 1993)

Definition of N?: Unranked – National rank not yet assessed.

National Conservation Rank (Canada): N? (09 Aug 1993)

Subnational Rank (States and Canadian Provinces)

Figure 1. Rank Status by State and Province

Status	State	Province
SX	Ohio	
SH	North Carolina	
S1	Maryland, New Jersey, Rhode Island, Washington	
S2	Connecticut, Idaho	
S3	Pennsylvania	Alberta
S5		Manitoba, Ontario, Prince Edward Island
S?	Michigan West Virginia	Saskatchewan
SR	Maine, Minnesota, New Hampshire, New York, Vermont, Wisconsin	British Columbia, Newfoundland Island, Labrador, New Brunswick, Nova Scotia, Nunavut, Quebec

Status Definitions

SX: Presumed Extirpated – Element is believed to be extirpated from the nation or state (province). Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.

SH: Possibly Extirpated (Historical) – Element occurred historically in the nation or state (province), and there is some expectation that it may be rediscovered. Its presence may not have been verified in the past 20 years. An element would become SH without such a 20-year delay if the only known occurrences were destroyed or if it had been extensively and unsuccessfully looked for.

S1: Critically Imperiled – Critically imperiled in the state because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation from the state (province). Typically 5 or fewer occurrences or very few remaining individuals (<1000).

S2: Imperiled – Imperiled because of rarity or because of some factor(s) making it very vulnerable to extirpation from the state (province). Typically 6 to 20 occurrences or few remaining individuals (1,000 to 3,000).

S3: Vulnerable – Vulnerable in the state (province) either because rare and uncommon, or found only in a restricted range (even if abundant at some locations), or because of other factors making it vulnerable to extirpation. Typically 21 to 100 occurrences or between 3,000 and 10,000 individuals.

S5: Secure – Common, widespread and abundant. Essentially ineradicable under present conditions. Typically with considerably more than 100 occurrences and more than 10,000 individuals.

S?: Unranked – State (province) rank not yet assessed.

SR: Reported – Element reported in the state (province), but without a basis for either accepting or rejecting the report, or the report not yet reviewed locally. Some of these are very recent discoveries for which the program hasn't yet received first-hand information; others are old, obscure reports. In other cases, the species may be common or of no concern for that state or province.

Other State Rankings

Connecticut – T (Threatened). Any native species documented by biological research and inventory to be likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range within the state and to have no more than nine occurrences in the state, and any species determined to be a “threatened species” pursuant to the federal Endangered Species Act, except for such species determined to be endangered by the Commissioner in accordance with section 4 of this act.

Idaho – 2 (State Priority 2). Taxa likely to be classified as Priority 1 within the foreseeable future in Idaho, if factors contributing to their population decline or habitat degradation or loss continue.

Maryland – E (Endangered). A species whose continued existence as a viable component of the state's flora or fauna is determined to be in jeopardy.

New Jersey – E (Endangered). An endangered species is one whose prospects for survival within the state are in immediate danger due to one or many factors – a loss of habitat, over exploitation, predation, competition, disease. An endangered species requires immediate assistance or extinction will probably follow.

Pennsylvania – PR (Pennsylvania Rare). Plant species, which are uncommon within this Commonwealth. All species of the native wild plants classified as Disjunct, Endemic, Limit of Range and Restricted are included within the Pennsylvania Rare classification.

Washington – S (Sensitive). Vulnerable or declining and could become Endangered or Threatened in the state.

DESCRIPTION

General nontechnical description: A creeping, slender-stemmed sub-shrub, brownish-bristly with somewhat appressed hairs on the stems, calyces, and the lower surface of the elliptic to obovate leaves (Caicco 1987). The flower parts are in fours and the bell-shaped, greenish-white corolla is 2-3 mm long. The berry is white (Rhoads and Block 2000). A low prostrate shrub that often forms mats.

Technical description: A prostrate, creeping, slender-stemmed sub-shrub, 2-4 dm long, very leafy with brownish-bristly, somewhat appressed hairs on the stem, calyces and lower surface of the leaves, especially when young; the young stem is greenish, becoming yellowish brown in age; leaves evergreen, crowded, broadly elliptic, subrotund to obovate, coriaceous, entire, revolute, 4-10 mm long and to 5 mm wide, green above with impressed midvein, underside paler; petioles 1.5-3.0 mm long and laterally twisted, giving the leaves a 2-ranked appearance; flowers few, mostly axillary and single on recurved pedicels 1 mm long, subtended by 2 ovate bracts that are longer than the calyx; calyx campanulate; corolla white, campanulate, 2.5 mm long, deeply 4-lobed, the rounded lobes a third as long as the tube; stamens 8, included, filaments flattened obovate to clavate, shorter than the anthers; anthers usually with 4 very short terminal points, opening by 2 large lateral pores; style exerted; stigma truncate; ovary 4-locular, its base adnate to accrescent calyx; fruit is a clear white, hispidulous, berry, 3-5 mm thick, 5-10 mm long, surrounded by the calyx, juicy, somewhat spicy, aromatic, with a mild flavor of wintergreen (Gleason 1952, Hitchcock et al 1959, Lakela 1965, Chadde 1998). See Fig. 2.



Figure 2. Drawing of *Gaultheria hispidula* (from Chadde 1998).

Local field characters and similar species: *Gaultheria hispidula* can be distinguished from other members of Ericaceae by the following combination of characters: densely hairy, prostrate stems; alternate, short-petioled leaves that have brown bristles on the lower surfaces and white berries.

Its leaves are less than 1 cm long, while other members of the genus have leaves over 1 cm. The most similar species is small cranberry (*Vaccinium oxycoccos*). Small cranberry grows in similar habitats and is sometimes associated with creeping snowberry. Its small, strongly reflexed flowers are very different from the campanulate flowers of creeping snowberry. Vegetatively they are superficially similar in appearance and could be confused. Small cranberry lacks the coarse bristles on the leaf undersides, which are prominent on the creeping snowberry. It also has distinctly revolute leaves while the leaves of *Gaultheria hispidula* are not rolled under. Cranberry (*Vaccinium macrocarpon*) vegetatively can also be similar in appearance, but is generally larger in most respects. It also lacks the coarse hairs or bristles of creeping snowberry.

SIGNIFICANCE

Natural: Berries are eaten by chipmunks and deer mice (Rook 1998).

Human: The berries of this species are sometimes eaten fresh, with cream and sugar or made into a preserve. Many northern tribes made a beverage from the leaves, sweetened with maple sugar. The berries of *Gaultheria hispidula* can be used to make a wintergreen liqueur. Tea made from the leaves also has a mild wintergreen flavor (Baldwin and Sims 1989).

This species is a rich source of methyl salicylate or oil of wintergreen, which has been used as an antiseptic, analgesic, flavoring agent, and carminative. Overdoses of this oil can be toxic (Rook 1998).

Disclaimer: The information provided here is for reference and historical use only. The use of this species for food or medicinal purposes is not recommended or condoned, without first consulting a physician.

Like many members of the heath family, creeping snowberry has some horticultural value. The dark, evergreen prostrate sub-shrub provides good ground cover, however it is slow growing and can be a challenge. Refer to the cultivation discussion under Population Biology for specifics.

GEOGRAPHICAL DISTRIBUTION

Geographical range: Creeping snowberry is distributed in the boreal region of North America from Labrador, west to British Columbia and south into the northern United States, where it occurs in Washington, Idaho, Minnesota, Wisconsin, Michigan, West Virginia, Pennsylvania, Maryland, New Jersey, New York, New Hampshire, Vermont, Maine, Rhode Island, and Connecticut. It is presumed extirpated in Ohio and possibly North Carolina (NatureServe 2000). It is more common in Canada where it occurs in all provinces, but not the Yukon and Northwest Territories. It seldom occurs north of 56 degrees North Latitude (Forest Capital of Canada 2001).

R9 National Forests: *Gaultheria hispidula* occurs on most of the northern National Forests of the Eastern Region including, the Green Mountain, Huron Manistee, Hiawatha, Ottawa, Chequamegon-Nicolet, Superior and Chippewa. It is classified as sensitive only on the Allegheny National Forest of Pennsylvania.

Allegheny National Forest: There is only one small population known to occur on the Allegheny National Forest. This is in the Queen Creek (Western PA Conservancy 1989) drainage, which is approximately 13 miles southwest of Warren. Other areas of suitable habitat can be found occasionally throughout the Forest. Another population occurs on private lands only four air miles east of the ANF boundary.

Distribution in Pennsylvania: In Pennsylvania, creeping snowberry is mostly limited to the northern third of the state, where it is sparsely scattered. While it does occur in the northwest, most populations are in the northeast part of the state. It has been recorded from the following counties: Erie, Warren, McKean, Elk, Clearfield, Potter, Clinton, Tioga, Lycoming, Sullivan, Luzerne, Susquehanna, Wayne, Lackawanna, Pike, Wyoming, Northampton, Monroe and Carbon (Figure 3. Rhoads and Klein 1993).

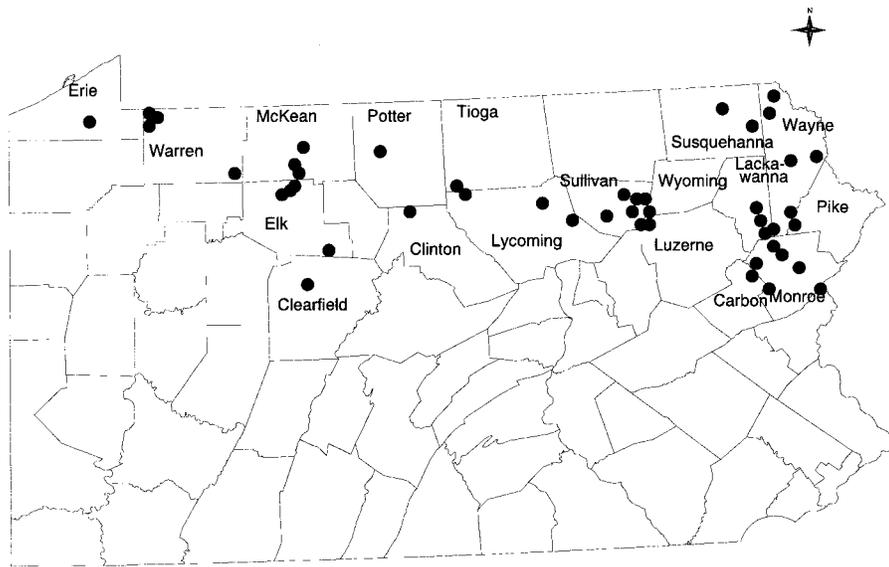


Figure 3. Distribution of *Gaultheria hispidula* in Pennsylvania (Rhoads and Klein 1993).

GENERAL ENVIRONMENT AND HABITAT DESCRIPTION

General summary: Habitat for this species is generally best described as bogs and wet woods, where it may occur on a variety of substrates including downed logs, stumps, mosses, mud and bare ground. The most common habitat appears to be sphagnum moss hummocks, growing up the bases of trees in paludified forests or in forested margins of meadows and beneath trees in scattered raised areas within meadows (Caicco 1987). These low, open areas in the northern latitudes are often cold and may support plant communities generally considered to be northern in distribution. Elevations can be variable, but the appropriate bog or marsh habitat is generally in the lowlands. However, in the more northern parts of its range, the species can sometimes be associated with upland habitats (Spickerman 2001).

In the eastern United States and Canada creeping snowberry is found in coniferous bogs of black spruce, tamarack, and cedar (Walshe 1980). In Minnesota, it is considered an occasional, but useful indicator of the Conifer Swamp Forest and the Black Spruce Bog plant communities (Aaseng et al. 1993). It also may occur in moss-covered surfaces in more upland aspen, fir, birch forest (Spickerman 2001). In northern Wisconsin it is found in the usual lowland conifer swamps but also occurs in upland forests (fir, white and black spruce, cedar, white and red pine); dry hemlock and white cedar; moist bedrock communities with cedar, hemlock and pine; and jack pine forest (north facing with sheet mosses and reindeer lichens) (Spickerman 2001).

The population on the Allegheny National Forest occurs in a small (180 ft. x 75 ft.) bog-like marsh that is mostly open except for a few a few small inclusions of eastern hemlock and with a border of hemlock, white pine, red maple, black cherry, serviceberry and where the ground is slightly higher. Shrubs including willows and winterberry are also present. The creeping snowberry grows in damp moss, in the open or semi-shade on fallen logs, exposed tree roots or around the bases of trees. Hemlock appears to be the main substrate (Western PA Conservancy 1989).

In western North America, the occupied habitats are similar, but the adjacent forests are made up of western white pine, western hemlock, and western red cedar. Lodgepole pine and Engelman spruce are also often present and indicate cold situations. These species are the coniferous species most often found in the hummocky transitional, sometimes paludified forests adjacent to peatland meadows (Caicco 1987).



Figure 4. Photograph of *Gaultheria hispidula* habitat (M. Hays photo)

National Wetland Inventory (NWI) classification types: Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. Generally wetlands must have one or more of the following three attributes: 1) at least periodically, the land supports hydrophytes; 2) the substrate is predominantly undrained hydric soil; and 3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year. The definitions for this classification system are derived from Cowardin et al (1979).

The NWI further defines wetlands in a series of general systems that are further divided into classes. *Gaultheria hispidula* is considered a wetland species that usually occurs in the Palustrine System. This system includes all non-tidal wetlands dominated by trees,

shrubs, emergent, mosses or lichens and all such wetlands that occur in tidal areas where salinity due to ocean derived salts is below 0.5 ppt. Wetlands lacking such vegetation are also included if they are less than 20 acres in size; do not have an active wave-formed or bedrock shoreline feature; have at low water a depth less than 2 meters in the deepest part of the basin; have a salinity due to ocean-derived salts of less than 0.5 ppt. The Palustrine system is bounded by upland vegetation or any of the other wetland systems recognized by the NWI.

The Palustrine System was developed to group the vegetated wetlands found throughout the United States that are traditionally referred to as marshes, swamps, bogs, fens, and prairies. Also included are the small, shallow, permanent or intermittent water bodies often called ponds. Palustrine wetlands may be situated shoreward of lakes, river channels, or estuaries; on river floodplains; in isolated catchments; or on slopes. They also may occur as islands in lakes or rivers.

The Palustrine System (P) is divided into Classes. Classes of the Palustrine System that may provide habitat for *Gaultheria hispidula* include the Forested (FO), Emergent (EM), and Moss-Lichen (ML). These attributes of this classification (Cowardin et al 1979) are defined as follows:

Forested (FO) – Characterized by woody vegetation that is 6 m tall or taller. All water regimes are included except subtidal.

Emergent (EM) – Characterized by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. These wetlands are usually dominated by perennial plants. All water regimes are included except subtidal and irregularly exposed.

Moss-Lichen (ML) – Includes areas where mosses or lichens cover substrates other than rock and where emergents, shrubs, or trees make up less than 30% of the area cover. The only water regime is saturated.

These classes can be further broken down into various vegetation and moisture divisions, but this is not done in this report.

In the Allegheny National Forest Wetland Rare Plant Survey (Western PA Conservancy 1989), additional information was given for these classification types:

Palustrine Forested (PFO) – (Wetlands dominated by either evergreen or deciduous, broad-leaved or needle-leaved trees, along with dead tree wetlands). These are relatively unusual in the region, especially mature stands.

Palustrine Emergent (PEM) – (Wetlands generally dominated by herbaceous vegetation and at the edges of deeper water). These are also uncommon in the region and have the potential for several rare species.

Palustrine Moss/Lichen (PML) – (Wetlands dominated by a moss or lichen canopy). Potentially these are sites commonly known as bogs. More likely to be found in the glaciated portion of Pennsylvania, bogs are rare community types that often harbor

special concern species. Usually they are small and at the extreme headwaters of small tributaries.

The wetland type where *Gaultheria hispidula* occurs on the ANF is described as: Palustrine, Saturated Broad-leaved Deciduous Forest (PFO) and Emergent (PEM). Across its range, creeping snowberry occurs in several different vegetation types in the Palustrine System. Creeping snowberry is not known to occur in the PML type on the ANF, however this wetland type is present on the Forest and is occupied by this species elsewhere in its range.

Physical characteristics

Climate: South of the eastern area of the subarctic climate, in the region between lat. 40 and 55 N. and from the continental interior to the east coast, lies the humid warm-summer continental climate. Located squarely between the source regions of polar continental air masses to the north and maritime or continental tropical air masses to the south, it is subject to strong seasonal contrasts in temperature as these air masses that shift north and south across the continent.

In the Koppen-Trewartha system (Trewartha 1968), this area is designated as Dcb, described as a cold, snowy winter climate with a warm summer. The Dcb climate has four to seven months when temperatures exceed 50°F (10°C), with no dry season. The average temperature during the coldest month is below 32°F (0°C). A short growing season imposes severe restrictions on agriculture; the frost-free season lasts from 100 to 140 days. Snow usually remains on the ground throughout winter. During this period, the region lies north of the main cyclonic belt; but during summer it lies within this belt, and the weather is changeable. The warm summer signified by the symbol b has an average temperature during its hottest month that never exceeds 72°F (22°C). Precipitation is ample all year, ranging from 24 to 45 inches (610 to 1,150 mm), but is substantially greater during the summer.

Measures on the northern unglaciated portion of the Allegheny Plateau, where the ANF is situated are generally slightly cooler and wetter than the region generally. Precipitation ranges from 40 to 50 inches (1020 to 1270 mm) per year, evenly distributed throughout the year. Snowfall averages from 50 to 100 inches (1270 to 2540 mm). Mean annual temperature ranges from 46 to 48°F (8 to 9°C). The growing season lasts from 120 to 150 days (McNab and Avers 1994).

Air and water requirements: According to the U.S. Fish and Wildlife Service wetland code (Reed 1988), *Gaultheria hispidula* is considered a Facultative Wetland (FACW) species. Species with this designation have a probability of occurring in wetlands under natural conditions of 67-99%.

Creeping snowberry most commonly grows in and around bogs and swamps in saturated soil conditions. A substrate is considered saturated if it is wet to the surface for extended periods during the growing season, but surface water is seldom present (Cowardin 1979).

The hummocky surfaces, stumps and other debris that provide substrates around the margins of these wet habitats indicate the narrow hydrologic conditions required by this species.

Physiographic provinces and topographic characteristics: In Pennsylvania, almost all populations of *Gaultheria hispidula* occur in the Allegheny Plateau Province. It is the largest physiographic region in the Appalachian Mountains and consists of rolling uplands that appear to be flat, and rolling uplands that are cut by deep, steep valleys. The plateaus have broad, shallow anticlines and synclines that trend in a northeast-southwest direction (Cuff et al 1989).

The Allegheny Plateau Physiographic Province is made up of several distinct sections. Some of these, including the Glaciated Low Plateau, Glaciated High Plateau, High Plateau, and the Northwestern Glaciated Plateau are more important than others when considering the distribution of *Gaultheria hispidula*. These sections are briefly described below. More complete descriptions of these and other sections of the Allegheny Plateau Physiographic Province in Pennsylvania can be found at the Pennsylvania DCNR web page (2001).

Glaciated Low Plateau: This section includes an area of diversified topography in northeastern Pennsylvania. The topography consists of rounded hills and broad to narrow valleys all of which have been modified by glacial erosion and deposition. Swamps and peat bogs are common in the eastern part of the section. The section reflects the interplay between bedrock of various types, mainly sandstones and siltstones, and glacial erosion and deposition. The more erosion-resistant rocks form the hills, while the less erosion-resistant rocks occur in the valleys. Glacial deposits, mainly glacial till or sand and gravel, may occur anywhere, but are found mainly in the valley bottoms and margins.

Glaciated High Plateau: This section consists of broad to narrow, rounded to relatively flat, elongate uplands separated in most places from the adjacent Glaciated Low Plateau section by a steep-sloped, well defined escarpment. These uplands are dissected by steep to shallow valleys. Each elongate upland corresponds to a syncline whose axis is in the approximated center of the up-land.

High Plateau: The High Plateau section consists of broad, rounded to flat uplands cut by deep angular valleys. The uplands are underlain by flat-lying sandstones and conglomerates. Drainage of the area has a dendritic pattern. The Allegheny National Forest is largely situated in this section.

Northwestern Glaciated Plateau: This section consists of many broad, rounded uplands cut by long, linear valleys. The uplands have a southeast-oriented linearity that is pronounced in eastern Erie and central Crawford Counties. Elsewhere upland linearity is obscure to absent. The uplands are cut by many flat-floored, narrow side valleys that are separated from adjacent uplands by steep slopes on one or both sides of the valley. The valleys are very linear and are oriented northwest – southeast for the most part although some valleys are normal to this orientation. The valley floors are often wetlands. There

is frequently a considerable depth of unconsolidated material beneath the valley floor. Drainage pattern is dendritic. Bedrock, which is largely covered by glacial deposits, consists of a variety of sandstones, siltstones and shales, as well as some conglomerates and coal. Bedding in the rocks is horizontal. Many of these rocks are relatively soft and were easily eroded into linear landforms by the continental glaciers.

As indicated, glaciation contributed to the shaping to the Pennsylvania landscape. Most recently, the Wisconsinan Glaciation covered the northeast and northwest corners of the state leaving surficial deposits of till which disrupted drainage patterns and created kettlehole lakes, bogs and extensive wetlands (Rhoads and Klein 1993). These habitats and associated areas often form prime suitable habitat for *Gaultheria hispidula*. Deposits of earlier Illinoian till occur south of the Wisconsinan border in several areas (Rhoads and Klein 1993).

Edaphic factors: The underlying rock types found in this province are residuum from sandstone, siltstone and shale with some conglomerate. The greatly varying soils include peat, muck, marl, clay, silt, sand, gravel and boulders in various combinations. Soil orders are highly variable depending upon the Physiographic sections. However, in areas of the northern Allegheny Plateau, Alfisols, Entisols, Inceptisols, and Ultisols are the dominant orders in the region. Temperature regime ranges from frigid at the summit of the plateau, to mesic in the valleys. Moisture regimes are udic and aquic (McNab and Avers 1994).

The hydric soils of the typical creeping snowberry site are moist to occasionally dry upland peat and wet sphagnum with a pH of 4.0-6.5 (USDA-NRCS 2001). Such soils are usually saturated with water and deprived of oxygen. Since decomposition is typically slow in the absence of oxygen, partially decomposed plant remains tend to accumulate in areas where water movement is minimal. The resulting soil type is called a Histosol or peat. In areas where water tends to circulate, organic matter may be continuously washed away leaving soils dominated by silt and clay (Purdue University 2001).

Dependence of this taxon on natural disturbance: The dependence of *Gaultheria hispidula* on natural disturbance processes is not clearly understood. However, the species usually does not occur in closed forests and rarely in completely open conditions. Occupied substrates are often old stumps or other woody debris situated in areas with transitional moisture and light regimes. Thus, it appears likely that at least long-term disturbances or other mechanisms of change may contribute to the preferred habitat.

Biological characteristics

Vegetation physiognomy and community structure: *Gaultheria hispidula* most often occurs on or near old logs or stumps in hummocky ground. These moist areas are often slightly raised above or along the margins of the lower wet ground. Mosses (especially *Sphagnum* spp.) and low vegetation generally dominate the open areas. *Gaultheria hispidula* is also found along the margins of bogs, which are also slightly raised above the

adjacent areas, where certain mesic tree and shrub species dominate. *Gaultheria hispidula* forms dense, small to large colonies or clumps on such transitional ground.

Regional vegetation types: Under Bailey's system (1995), creeping snowberry occurs in many regional vegetative types of the United States. Listed in order of Domain, Division and Province, the most important ecological units are listed below.

- Humid Temperate Domain (eastern U.S.)
 - Warm Continental Division
 - Laurentian Mixed Forest Province
 - Warm Continental Regime Mountains
 - Adirondack – New England Mixed Forest – Coniferous Forests
 - Hot Continental Division
 - Eastern Broadleaf Forest (Oceanic) Province
 - Eastern Broadleaf Forest (Continental) Province
- Dry Domain (Idaho and Washington)
 - Temperate Steppe Regime Mountains
 - Northern Rocky Mountains – Coniferous Forest Province

The most significant Provinces for *Gaultheria hispidula* in Pennsylvania and on the Allegheny National Forest are the Laurentian Mixed Forest Province and the Eastern Broadleaf Forest (Oceanic) Province, which are further divided into Sections and finally Landtypes. Detailed descriptions of all vegetative Provinces and Sections can be found in McNab and Avers (1994).

The Laurentian Mixed Forest Province occurs mostly in the upper Great Lakes States, and upper New England including portions of Minnesota, Wisconsin, Michigan, Pennsylvania, New York Vermont, and Maine. It is delineated into thirteen sections (McNab and Avers 1994). Most of northern Pennsylvania and much of the Allegheny National Forest fall within two of these: the Northern Glaciated Allegheny Plateau and the Northern glaciated Allegheny Plateau.

The Kuchler (1964) vegetation types for these Sections are similar and include the Northern Hardwoods forest, which occupies the higher elevations of the Allegheny Plateau and the Appalachian oak forest, which is more dominant in the lower two-thirds of the state. Eastern hemlock and American beech-hemlock forests are abundant on moist sites, while American beech-sugar maple forests are common on better-drained sites. Common associates include red maple, sweet birch, black cherry, white ash, yellow birch, eastern white pine, yellow poplar, and cucumber tree (McNab and Avers 1994). The Northern hardwood forests would be the most dominant on the Allegheny National Forest and most occurrences of *Gaultheria hispidula* occur in appropriate habitats within this more northern forest type.

The Eastern Broadleaf Forest Province is located in the eastern conterminous States, including parts of Tennessee, Kentucky, West Virginia, Ohio, Pennsylvania, New York, New Jersey, Rhode Island, Massachusetts, New Hampshire, and Maine. It is delineated

into nine sections (McNab and Avers 1994). The Western Glaciated Allegheny Plateau Section forms the northern part of the Province within the State of Pennsylvania, including small portions of the Allegheny National Forest.

The Kuchler (1964) vegetation types in the region would also be Northern Hardwood forests with some Appalachian oak forest. Other recognized types in this section include maple-ash-oak swamp forest, wet beech forest, beech-sugar maple forest, oak-maple forest, and mixed oak forest (McNab and Avers 1994). However, most of these other types are not well represented or are absent from parts of the state where *Gaultheria hispidula* is typically found.

On the local scale, ecological landtype units are used to characterize sites. The known creeping snowberry location on the Allegheny National Forest falls in the FP3 (flood plain with poorly drained soils) landtype. The FP3 landtype (Moriarity 1996) is described as poorly to very poorly drained, very deep, nearly level flood plain from sediment washed from uplands derived from sandstone and shale; medium to strongly acid; depth to bedrock is 5 feet plus; the solum may have up to 5% stone fragments. FP3 is long and narrow in shape and wetlands are prevalent.

Similar and adjacent landtypes are closely intermingled in a mosaic that may also provide suitable habitat and occurrences of creeping snowberry. These landtypes are various units in the UB (upper bottom) and DS (depressions) types where wetlands may occur. Refer to Moriarity (1996) for descriptions of these landtypes.

Typical associated species - Eastern North America (Aaseng et al. 1993, Rhoads 1993)

Trees: balsam fir (*Abies balsamea*), red maple (*Acer rubrum*), paper birch (*Betula papyrifera*), white spruce (*Picea glauca*), black spruce (*Picea mariana*), jack pine (*Pinus banksiana*), red pine (*Pinus resinosa*), eastern white pine (*Pinus strobus*), large leaf aspen (*Populus grandidentata*), quaking aspen (*Populus tremuloides*), pin cherry (*Prunus pensylvanica*) tamarack (*Larix laricina*).

Shrubs: green alder (*Alnus crispa*), juneberries (*Amelanchier* sp.), pipsissewa (*Chimaphila umbellata*), sweet fern (*Comptonia peregrina*), round leaf dogwood (*Cornus rugosa*), beaked hazel (*Corylus cornuta*), low bush honeysuckle (*Diervilla lonicera*), trailing arbutus (*Epigaea repens*), common juniper (*Juniperus communis*), twinflower (*Linnaea borealis*), fly honeysuckle (*Lonicera canadensis*), late low blueberry (*Vaccinium angustifolium*), velvet leaf blueberry (*Vaccinium myrtilloides*), mountain cranberry (*Vaccinium vitis-idaea*), small cranberry (*Vaccinium oxycoccos*), bog laurel (*Kalmia polifolia*), Labrador tea (*Ledum groenlandicum*), leatherleaf (*Chamaedaphne calyculata*) Bog-rosemary (*Andromeda glaucophylla*), mountain azalea (*Rhododendron prinophyllum*), chokeberry (*Aronia* sp.).

Herbs (including ferns): wild sarsaparilla (*Aralia nudicaulis*), bunchberry (*Cornus canadensis*), large leaf aster (*Aster macrophyllus*), blue bead lily (*Clintonia borealis*),

gold thread (*Coptis trifolia*), moccasin flower (*Cypripedium acaule*), dwarf rattlesnake plantain (*Goodyera repens*), Canada mayflower (*Maianthemum canadense*), bracken fern (*Pteridium aquilinum*), shinleaf (*Pyrola* sp.), pale pea (*Lathyrus ochroleucus*), bedstraw (*Galium* sp.), starflower (*Trientalis borealis*), violets (*Viola* spp.), false Solomon's seal (*Smilacina trifolia*), sundew (*Drosera rotundifolia*).

Graminoids: three-seeded bog sedge (*Carex trisperma*), hop sedge (*Carex lupulina*), shallow sedge (*Carex lurida*), bristle-stalked sedge (*Carex leptalea*), bog sedge (*Carex atlantica*), tussock cotton-grass (*Eriophorum spissum*).

Ground Cover: ground pine clubmoss (*Lycopodium obscurum*), sphagnum mosses (*Sphagnum* spp.), dicranum moss (*Dicranum* sp.), Schreber's feathermoss (*Pleurozium schreberi*), hair cap moss (*Polytrichum commune*) and lichens including reindeer moss (*Cladonia* sp.).

Western North America (Caicco 1987, Hitchcock and Cronquist 1973)

Trees: western white pine (*Pinus monticola*), lodgepole pine (*Pinus contorta*), western hemlock (*Tsuga heterophylla*), western redcedar (*Thuja plicata*), and Englemann spruce (*Picea engelmannii*).

Shrubs: small cranberry (*Vaccinium oxycoccos*), alpine laurel (*Kalmia microphylla*), bog willow (*Salix pedicellaris*), Bebb's willow (*Salix bebbiana*), Menzies's spirea (*Spiraea douglasii*) and bog birch (*Betula glandulosa*).

Herbs (including ferns): arrowleaf groundsel (*Senecio triangularis*), lady fern (*Athyrium filix-femina*), skunk cabbage (*Lysichitum americanum*), sundew (*Drosera rotundifolia*), northern starflower (*Trientalis arctica*), elephant's head (*Pedicularis groenlandica*), purple cinquefoil (*Potentilla palustris*), cow-wheat (*Melampyrum lineare*), lesser bladderwort (*Utricularia minor*).

Graminoids: bluejoint reedgrass (*Calamagrostis canadensis*), mud sedge (*Carex limosa*), beaked sedge (*Carex utriculata*), bristle-stalked sedge (*Carex leptalea*), poor sedge (*Carex paupercula*), slender sedge (*Carex lasiocarpa*), Sitka sedge (*Carex sitchensis*), Chamisso's cotton-grass (*Eriophorum chamissonis*), slender cotton-grass (*Eriophorum gracile*).

Ground Cover: sphagnum mosses (*Sphagnum* spp.), reindeer moss (*Cladonia* sp.), dicranum moss (*Dicranum* sp.), hair cap moss (*Polytrichum commune*).

ANF population (Western PA Conservancy 1989)

Trees: eastern hemlock (*Tsuga canadensis*), eastern white pine (*Pinus strobus*), red maple (*Acer rubrum*), black cherry (*Prunus serotina*), black ash (*Fraxinus nigra*).

Shrubs: serviceberry (*Amelanchier* sp.), willow (*Salix sericea*), winterberry (*Ilex verticillata*), dewberry (*Rubus hispidus*).

Herbs (including ferns): purple-stemmed aster (*Aster puniceus*), flat-topped white aster (*Aster umbellatus*), marsh marigold (*Caltha palustris*), turtlehead (*Chelone glabra*), golden saxifrage (*Chrysosplenium americanum*), goldthread (*Coptis groenlandica*), purple-leaved willow-herb (*Epilobium coloratum*), willow-herb (*Epilobium leptophyllum*), rough bedstraw (*Galium asprellum*), bedstraw (*Galium tinctorium*), dwarf St.-John's-wort (*Hypericum mutilum*), marsh pennywort (*Hydrocotyle americana*), jewelweed (*Impatiens capensis*), bugleweed (*Lycopus* sp.), arrow-leaved tearthumb (*Polygonum sagittatum*), Marsh buttercup (*Ranunculus hispidus*), mad-dog skullcap (*Scutellaria lateriflora*), (*Solidago rugosa*), spreading goldenrod (*Solidago patula*), bur-reed (*Sparganium chlorocarpum*), nodding ladies'-tresses (*Spiranthes cernua*) common cat-tail (*Typha latifolia*), false hellebore (*Veratrum viride*), blue marsh violet (*Viola cucullata*).

Ferns: cinnamon fern (*Osmunda cinnamomea*), sensitive fern (*Onoclea sensibilis*), crested shield fern (*Dryopteris cristata*),

Graminoids: rice cutgrass (*Leersia oryzoides*), wool-grass (*Scirpus cyperinus*), bulrush (*Scirpus polyphyllus*), autumn bent (*Agrostis perennans*), hairgrass (*Agrostis scabra*), drooping woodreed (*Cinna latifolia*), slender managrass (*Glyceria melicaria*), fowl managrass (*Glyceria striata*), velvet grass (*Holcus lanatus*), brome hummock sedge (*Carex bromoides*), brownish sedge (*Carex brunnescens*), fringed sedge (*Carex crinita*), bristle-stalked sedge (*Carex leptalea*), shallow sedge (*Carex lurida*), drooping sedge (*Carex prasina*), sawbeak sedge (*Carex stipata*), three-seeded bog sedge (*Carex trisperma*), sharp-fruited rush (*Juncus acuminatus*), Canada rush (*Juncus canadensis*), soft rush (*Juncus effusus*).

Ground Cover: sphagnum mosses (*Sphagnum* spp.), *Hypnum* sp.

Dominance and frequency: Considering suitable habitats rangewide, *Gaultheria hispidula* generally is a minor constituent, however it may be common in some northern areas. On the more local scale, it may occasionally be common, but normally is a minor component, occupying a small portion of the apparently suitable habitat where it occurs. The only known population on the Allegheny National Forest consists of six small clumps, the largest being 10 square ft. in size (Western PA Conservancy 1989).

Successional phenomena: Creeping snowberry appears to have narrow hydrologic requirements being found around the edges of bogs and wetlands and on hummocky ground of such general habitats. Any changes in the environment that raise or lower the water table, would be expected to impact the species negatively. However, there is evidence that some occupied sites have undergone significant disturbance events or changes in the successional stage. Old stumps are frequently utilized as a primary substrate around the margins of swamps or bogs. While changes in the water table may be harmful for some existing plants, the shrub seems capable of dispersing to appropriate hydrologic conditions. Thus it appears there may be some response by this species to successional changes.

Other species of concern: *Gaultheria hispidula* is usually associated with unique or specialized habitats that are uncommon or rare. These habitats are host to an assortment of other specialist species, of which many are species of concern.

Due to the extensive range and diverse habitats of *Gaultheria hispidula* in the eastern United States, a list of potential associated uncommon or rare species is too extensive to include. However a partial list of species that may co-occur across the State of Pennsylvania includes, pod grass (*Scheuchzeria palustris*), waterberry (*Lonicera villosa*), small yellow lady's-slipper (*Cypripedium calceolus* var. *parviflorum*), bog rosemary (*Andromeda polifolia* var. *glaucophylla*), Labrador-tea (*Ledum groenlandicum*), mud sedge (*Carex limosa*), few-seeded sedge (*Carex oligosperma*), few-flowered sedge (*Carex pauciflora*), many-fruited sedge (*Carex lasiocarpa*), soft-leaved sedge (*Carex disperma*), rough cotton-grass (*Eriophorum tenellum*), and bog bluegrass (*Poa paludigena*) among others (Rhoads and Klein 1993). In the vicinity of the ANF, populations of creeping snowberry occur with these PA State or locally rare plant species: mountain juneberry (*Amelanchier bartramiana*), Wiegand's sedge (*Carex wiegandii*), soft-leaved sedge (*Carex disperma*), southern twayblade (*Listera australis*), and wild red currant (*Ribes triste*) (Western PA Conservancy 2001).

In the western United States, uncommon or rare species that often occur in similar habitat as creeping snowberry include: small cranberry (*Vaccinium oxycoccos*), bog willow (*Salix pedicellaris*), bristle-stalked sedge (*Carex leptalea*), northern starflower (*Trientalis arctica*), Sitka sedge (*Carex sitchensis*), bog rosemary (*Andromeda polifolia*), dwarf birch (*Betula pumila* var. *glandulifera*), Buxbaum's sedge (*Carex buxbaumii*), string-root sedge (*Carex chordorrhiza*), pale sedge (*Carex livida*), poor sedge (*Carex paupercula*), crested shield fern (*Dryopteris cristata*), swamp willow-weed (*Epilobium palustre*), green keeled cotton-grass (*Eriophorum viridicarinum*), northern bog clubmoss (*Lycopodiella inundata*), arrowleaf coltsfoot, (*Petasites sagittatus*), white beakrush (*Rhynchospora alba*) and pod grass (*Scheuchzeria palustris*) among others (Mousseaux 1997).

POPULATION BIOLOGY

General summary: In Pennsylvania, most occurrences of *Gaultheria hispidula* are very small and obscure in areas of habitat that can sometimes be large. The species is not easily observed or relocated due to its relatively small size among dense vegetation. Due to these difficulties, accurate data or even estimates on population size are generally lacking. Populations are typically assumed to be small based upon narrow requirements of suitable habitat and species biology. Limitations on survey efforts likely are responsible for the lack of site-specific population information on known occurrences.

The population on the ANF is believed to hold six individuals or clumps of creeping snowberry. However, there is ample suitable habitat in the area in which this species can easily be hidden (Western PA Conservancy 2001).

Phenology: *Gaultheria hispidula* blooms in mid spring, with an active growth period in spring and summer.

Type of reproduction: Creeping snowberry reproduces by seed and vegetatively by rhizomes (Rook 1998).

Pollination: Autogamy (Brooklyn Botanical Garden 2001). Self-sterile; dependent on pollinators such as bumblebees, solitary bees, bee flies and syrphid flies (Rook 1998).

Dispersal: Endozoochory. Seed spread rate is slow and carried out mostly by chipmunks and deer mice (Brooklyn Botanical Garden 2001). Seedling vigor is low and vegetative spread is at a moderate rate (USDA-NRCS 2001).

Seed biology: The typical fruit contains many seeds that are light orange-yellow, irregularly wedge-shaped, 0.7-1 mm long, 0.5-0.7 mm wide, wingless, not tailed, lineolate or lineate (Brooklyn Botanical Garden 2001). The seeds are finely longitudinally striate (Lakela 1965) and relatively small at 3,000,000 per pound (USDA-NRCS 2001). Fruits with seed are considered persistent and set begins in summer and ends in the fall.

Cultivation: Creeping snowberry can be successfully propagated by bare root, container stock, cuttings, and seed. The seed requires cold stratification, and has medium fertility, moisture and pH ranges. Seed abundance and seedling vigor are considered low and vegetative spread is moderate (USDA-NRCS 2001). There is no record of propagation for conservation purposes.

POPULATION ECOLOGY

General summary: In Pennsylvania, populations of *Gaultheria hispidula* are generally small and localized. Plants inhabit relatively undisturbed bog or swamp habitat that generally does not remain intact with disturbance or alterations that impact the water table. It is anticipated that alteration of such habitats from a variety of disturbance agents has caused some population decline for this species. However, there is little quantitative data regarding the effects of herbivores, disease, competition, hybridization or allelopathy on population viability.

No native plant species appear to substantially compete with *Gaultheria hispidula* for space or moisture. It is not certain if any exotic species pose a significant threat at this time. Most weedy species invade habitats not utilized by creeping snowberry, however there are some; including purple loosestrife (*Lythrum salicaria*) and reed canary grass (*Phalaris arundinacea*) that do invade similar wet habitats. Surveys of known snowberry sites or suitable habitat should note any weed species in the area that could potentially be a detriment to the native plant community.

Herbivory is not anticipated to be a significant problem to this species; however, this needs to be assessed in the field. Indirect effects such as trampling and habitat

degradation would be considered more serious threats. A final concern for the species is the small population size of some occurrences. The ANF population is very small, thus there are concerns for population viability in the face of natural fluctuations in habitat and population structure. In addition, impacts from any potential disturbance agents would be greatly enhanced due to the small baseline population.

CURRENT LAND OWNERSHIP

Populations occur on a variety of ownerships across the State of Pennsylvania. Of the fourteen occurrences known in the vicinity of the Allegheny National Forest, land ownership includes State, Federal and various private interests. According to Element Occurrence Records on file at the Western PA Conservancy (2001) land ownership of these regional populations, including occurrence number can be summarized as follows (including element occurrence number):

State of Pennsylvania

- DER/Bureau of Forestry – 4 occurrences (001, 009, 010, 012)
- PA DCNR/Bureau of Forestry – 1 occurrence (014)
- PA Game Commission – 1 occurrence (008)

Federal

- Allegheny National Forest – 1 occurrence (013)

Private

- Private Company – 2 occurrences (006, 015)
- Private Individuals – 1 occurrence (003)

Unknown

- 4 occurrences (004, 005, 007, 011)

MANAGEMENT

The boggy and swampy habitats inhabited by creeping snowberry generally are not sites of specific management activities. Historically, these habitats were sometimes used for transportation purposes, due to the open nature and gentle grade of the valley bottoms. Occasionally these bogs support large populations of native cranberries (*Vaccinium macrocarpon*), which may be visited by berry pickers. Numerous adjacent management activities may have indirect impacts to these habitats through changes to the water table. The potential impacts of these activities are discussed in the following section.

Land management history at the ANF occurrence is limited to historic railroad use and adjacent forestry practices. The old railroad grade remains and has possibly altered the area of suitable habitat for creeping snowberry through alterations in the local water table. At this location, creeping snowberry is most common in an area transitional between the open riparian area and the upland forest. This area has not been impacted by

timber harvest, but the forest stands further up the slope have had some periodic harvest, which also may have impacted the local water table.

There is no significant use or management of creeping snowberry itself and there are no formal conservation measures in place for this species or for the site in which it occurs on the ANF. However, species listed sensitive by the Regional Forester are protected from activities that may negatively impact viability or contribute formal listing of the species (see Introduction). Current management appears compatible with the long-term viability of creeping snowberry at the site.

EVIDENCE OF THREATS

Threatened destruction, modification or curtailment of habitat or range: Direct physical destruction of this species or its habitat probably occurred more often historically due to habitat alterations in wetlands and riparian areas. Large-scale timber removal was significant early in the 1900s when harvest occurred without regard to sensitive habitats such as those utilized by creeping snowberry. Many areas of suitable habitat were likely drained and cleared for agricultural purposes. An old railroad bed passes through the population known to occur on the ANF. It is likely that railroads and other human uses altered the preferred habitat in many areas. Due to the sensitive water table and the species' shallow roots, any action impacting the ground surface would likely have harmful effects. Creeping snowberry is also susceptible to fire, however suitable habitat rarely burns under natural conditions. Natural disturbances such as fire, ice storms or tornados may rarely impact suitable habitat, but generally would not have long lasting impacts on this species.

In more recent times, wet habitats are generally protected from direct impacts that may alter the ground surface. However, any action that raises or lowers the water table could potentially impact this species due to its narrow hydrologic requirements. In some areas ORV use in meadows or wet boggy areas for recreation is increasing. Such actions will result in loss of habitat through significant destruction of the ground surface and possible extirpation of this and other species present. The installation of oil and gas wells and pipelines may be harmful to suitable habitat. In the 1970s one known site under private ownership was partially mined for peat. It is not known to what extent the habitat or population was affected (Western PA Conservancy 2001).

Potentially significant modification of this species' habitat could come from invasive plant species. However, most weedy species are limited to open, dry sites such as rock pits, roadsides or waste areas and are not a threat to creeping snowberry or its habitat. However, there are some species that do invade wetlands or swamp areas. Purple loosestrife (*Lythrum salicaria*) is found on the ANF and is likely to expand into appropriate habitats in the future. Where it occurs, purple loosestrife can significantly reduce species diversity and eliminate many native species. Additional invasive species that have potential to invade moist habitats include Japanese knotweed (*Polygonum cuspidatum*), common reed (*Phragmites australis*), reed canary grass (*Phalaris arundinacea*) and others.

Overutilization for commercial, sporting, scientific, or educational use: Human uses of this species include food and the collection of landscaping material, but such pressure is generally very light. On the ANF such use is non-existent due to the very low occurrence. *Gaultheria hispidula* is a species of concern throughout parts of its range. As a result, its sensitive habitats are frequently visited by concerned parties, who may make collections for educational uses or to document occurrence.

As stated, ORV use poses a significant risk to the moist, boggy habitats of this species.

Disease, predation, or grazing: Another potential direct impact to the species or its habitat could be through grazing pressure. It is palatable to both humans and livestock and can be easily dislodged due to shallow root depths. Concentrations of livestock in some areas may contribute to soil compaction and alterations in site hydrology. On the ANF, livestock does not pose a significant threat to this species. However, the region's excessive deer population may pose some grazing pressure, but the extent of the problem is unknown.

Inadequacy of existing regulatory mechanisms: Fragmented ownership, such as found within the ANF boundary presents a potential problem in the conservation of this species, because private lands are not subject to most land use restrictions. Any changes in the habitat on these lands could result in loss or reduction of potential populations or the degradation of suitable habitats.

Other natural or manmade factor: The very narrow habitat conditions this species seems to occupy makes it susceptible to any natural or manmade changes in its environment. This narrow existence combined with typically small population sizes makes it especially vulnerable.

RESEARCH AND MONITORING

Much is known in general about the distribution and occurrence of creeping snowberry. However, there is much to learn about the biology and ecology of the species. Assumptions and inferences about its response to changes in its environment can be made based on some observations, but formal monitoring has not occurred. Monitoring the known population on the ANF as well as continued field searches for additional populations are needed to answer management questions and to obtain baseline information.

In the west, substantial general information about creeping snowberry is the result of research of wetland species and communities in the State of Idaho (Caicco 1987, Moseley 1989, Bursick 1992).

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PEER REVIEW

The following individuals have provided much appreciated comments for the benefit of this Conservation Assessment:

Nancy Berlin – USFS, Regional Office

Marjy Brzeskiewicz – USFS, Chequamegon-Nicolet National Forest

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Dr. Ann Rhoads – Pennsylvania State University

Todd Ristau – USFS, Northeast Forestry Science Lab
Steven Spickerman – USFS, Chequamegon-Nicolet National Forest
Linda Schwartz, Hiawatha National Forest