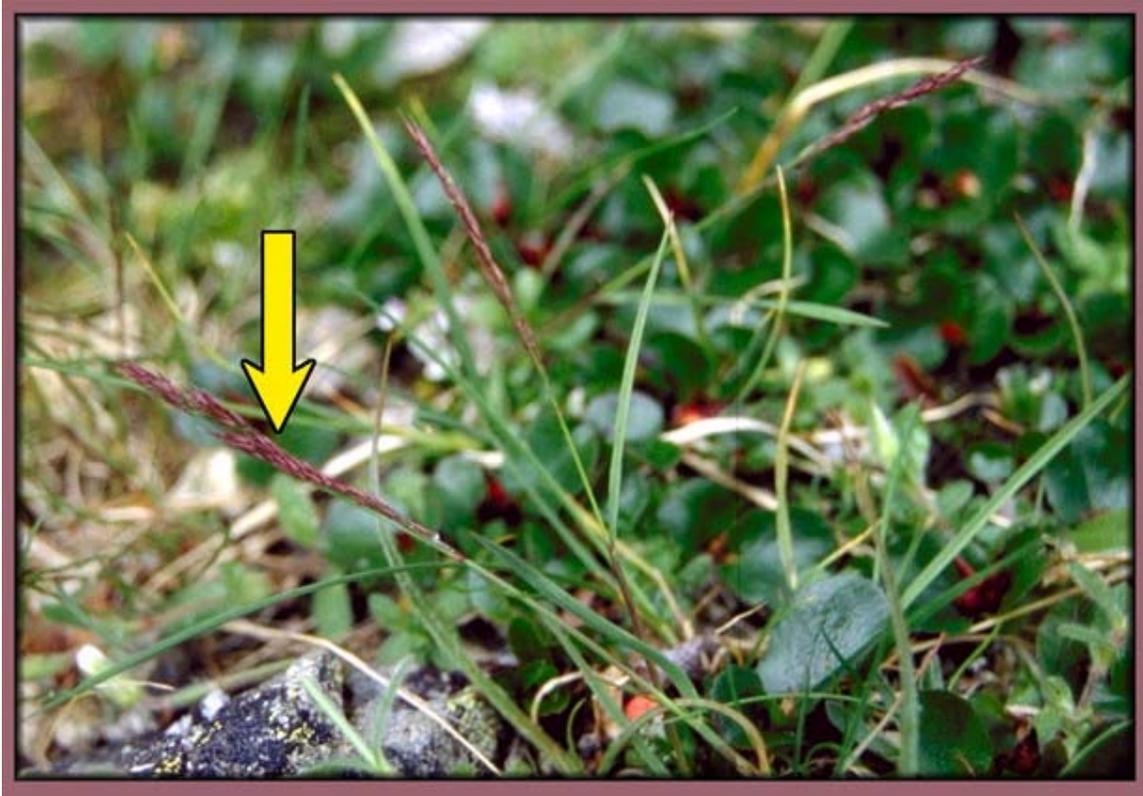


*Conservation Assessment  
for  
Arctic bentgrass (Agrostis mertensii) Trin.*



*Photo credit: L. L. Consaul*

***USDA Forest Service, Eastern Region***  
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*This Conservation Assessment was prepared to compile the published and unpublished information on the subject taxon or community; or this document was prepared by another organization and provides information to serve as a Conservation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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## **EXECUTIVE SUMMARY**

*Agrostis mertensii* Trin., otherwise known as arctic bentgrass, is a short-lived perennial member of the grass family. The plants form tufts and are usually less than 6 inches tall. The unremarkable wind-pollinated flowers appear from June through August, and fruit is set in August and September. The species appears to rely on good seed set and seedling establishment to colonize new areas.

There are no taxonomic issues with *Agrostis mertensii*, although there are several species that are similar to it. Proper identification relies on a number of technical features, and people who are not familiar with grass keys and terminology may have difficulty when trying to identify plants.

The species is relatively common in the alpine communities of New Hampshire, and is less common New York, Maine, and Vermont. It occurs at a number of high altitude locations in West Virginia, though these sites are not alpine. It is found in alpine and subalpine habitats in the Northeast, and in riparian situations and open forests in West Virginia.

*Agrostis mertensii* is a circumboreal species, and is found in the mountains of the western United States as well as in the Northeast and the Central Appalachians. In New Hampshire, it is ranked S3 and is known from at least 13 extant occurrences, most of which lie within the White Mountain National Forest. The species is no longer tracked in New Hampshire. It is ranked S2 in Maine, with 6 extant occurrences. In Vermont, it is ranked S1 and there are 4 extant occurrences, one of which is from the Green Mountain National Forest. It is on the Green Mountain National Forest's Regional Forester's Sensitive Species list. It is ranked S2 in New York and is known from 10 extant occurrences, all of which are within Adirondack Park. In West Virginia, it is ranked S1, with 4-6 extant occurrences, 4-5 of which are from Monongahela National Forest. It is on the Monongahela National Forest's Regional Forester's Sensitive Species list.

The main threat to *Agrostis mertensii* is loss of individual plants and suitable habitat due to recreational activities. Direct trampling, soil compaction, and soil erosion all result from hiker foot traffic and off-trail wandering. Air pollution, acid rain, and global warming may have long-term effects on the viability of the species and its alpine habitats.

Current regulations are not effective at controlling threats from recreational use or from environmental changes due to human activities.

Currently, only the populations on Vermont's alpine peaks are managed under active conservation programs. The Green Mountain Club is responsible for summit stewardship programs and revegetation projects on a few mountains. In several states, management plans are in place for some of the lands on which *Agrostis mertensii* occurs, but there is little in the way of active conservation in Maine, New Hampshire, New York, and West Virginia. Since *Agrostis mertensii* is widespread in alpine habitats, it may be a good indicator species that can reflect the overall health and integrity of the alpine system in the Northeast.

## **ACKNOWLEDGEMENTS**

I owe many thanks to Lisa St. Hilaire, who wrote the initial literature review of *Agrostis mertensii* for the White Mountain National Forest and Green Mountain National Forest. Her excellent writing and organization of information served as the basis for much of the following document. I reorganized and rewrote sections that were similar to those in the literature review, and cited the original sources, so I rarely cite Lisa's work directly, but I could not have written this document without her. Thanks are due to Diane Burbank of the Green Mountain National Forest; Sara Cairns, Bill Nichols, and Dan Sperduto at New Hampshire Natural Heritage Bureau; Heather Root for directing me to Pete Antos-Ketcham at the Green Mountain Club; Stacy Lemieux of the White Mountain National Forest; Bob Popp and Jodi Shippee at Vermont Nongame and Natural Heritage Program; Don Cameron and Emily Pinkham at Maine Natural Areas Program; Alice Schori at the Appalachian Trail Conference; Steve Young at New York Natural Heritage Program; the botanists at West Virginia Natural Heritage; Melissa Thomas-Van Gundy of Monongahela National Forest. Thanks especially to MaryBeth Deller, my contracting officer at the Green Mountain National Forest.

## **INTRODUCTION**

*Agrostis mertensii* is a short-lived perennial member of the grass family. Plants reproduce sexually through flowers and fruit and asexually through limited clonal growth. The species is relatively common in the alpine communities of New Hampshire, and is less common in New York, Maine, and Vermont. It occurs in non-alpine habitat in West Virginia. There are no significant taxonomic issues with *Agrostis mertensii*.

*Agrostis mertensii* is a circumboreal species, and is found in the mountains of the western United States as well as in the Northeast and Central Appalachians. It is ranked S3 in New Hampshire, S2 in Maine, S1 in Vermont, S2 in New York, and S1 in West Virginia. It is on the Green Mountain National Forest's and Monongahela National Forest's Regional Forester's Sensitive Species lists. It is not tracked in New Hampshire.

This assessment includes sections on taxonomy, life history, and population biology. There is an extensive section that describes alpine and subalpine habitats in the Northeast, with a much smaller habitat overview for West Virginia. Occurrence information for Maine, New Hampshire, Vermont, New York, and West Virginia is included in the Distribution and Status section. The last sections cover threats to the species, conservation and management activities, land ownership and habitat protection, and research and monitoring activities.

This assessment is designed to concentrate on occurrences within the Green Mountain National Forest and Monongahela National Forest, National Forests in Region 9 with *Agrostis mertensii* on their Regional Forester's Sensitive Species list. Since the alpine zone and/or the species is found in New York, Maine, New Hampshire, and parts of Vermont and West Virginia that are not within the Forests, those areas are included as

well. Similar assessments are being written for *Juncus trifidus*, *Vaccinium uliginosum*, and *Carex bigelowii*. These species share similar habitats in the Northeast and are widespread enough to serve as good indicators of the overall health of the alpine system.

## **NOMENCLATURE AND TAXONOMY**

*Agrostis mertensii* Trin. was named in 1836. Synonyms are numerous and include *Agrostis canina* var. *mertensii* (Trin.) Kuntze, *Agrostis laxiflora* var. *mertensii* (Trin.) Griseb., *Agrostis bakeri* Rydb., *Agrostis boliviana* Mez, *Agrostis borealis* fo. *macrantha* (Eames) Fernald, *Agrostis borealis* Hartm., *Agrostis canina* var. *mertensii* (Trin.) Kuntze, *Agrostis compressa* Döll, *Agrostis gelida* Trin., *Agrostis poeppigiana* Phil., *Agrostis scabra* var. *montana* Tuck. ex Vasey, *Agrostis viridissima* Kom. *Agrostis williamsii* Phil., *Agrostis canina* var. *alpina* Oakes, *Agrostis canina* var. ? *tenella* Torr., *Agrostis pickeringii*, *β rupicola* Tuckerman, and *Trichodium concinnum* (Tuckerm.) Wood (Fernald 1933, MOBOT 2001).

In the Northeast, there are two species that are similar to *Agrostis mertensii* – *Agrostis canina* and *Agrostis elliottiana*. All three species have a long awn on the lemma. *Agrostis canina* and *Agrostis mertensii* are both perennials and both have a geniculate awn. *Agrostis canina* is introduced from Europe, has scabrous panicle-branches, and has cauline and basal leaves. It is typically found in fields and low meadows. *Agrostis mertensii* differs in its glabrous panicle-branches, mostly basal leaves, and habitat of peaty and rocky soil on higher mountains. *Agrostis elliottiana* is an annual with a long, flexuous awn on the lemma and is found in woods, barrens, fields and roadsides (Gleason and Cronquist 1991).

## **DESCRIPTION OF SPECIES**

*Agrostis mertensii* is a member of the Poaceae (grass family). It is a densely tufted perennial, 1-5 dm high. Leaves are mostly crowded at the base, with blades that are flat or inrolled and 1-3 mm wide. The ligules at the top of the leaf sheaths are mostly truncate and are 1-2 mm long. The inflorescence is pyramidal, 5-15 cm tall, with glabrous or nearly glabrous branches, and forks near the middle. The spikelets are 1-flowered, purplish, and 2-4 mm long. The glumes are about equal, narrow, acute or acuminate, 1-veined, and somewhat keeled. The first glume is often scabrous along the midvein and the second glume is usually glabrous. The lemma is obscurely nerved, 1.6-2.8 mm, with a bent awn 3-6 mm long that is borne at or near its middle. The callus is shortly bearded, the palea is very short (to 0.5 mm), and the anthers are 0.5-0.7 mm (Gleason and Cronquist 1991). On New England summits, *Agrostis mertensii* is usually less than 6 inches high (Slack and Bell 1995).

## **LIFE HISTORY**

*Agrostis mertensii* is a short-lived perennial that lives four years per generation (Kurchenko 1991). It has a relatively shallow root system that extends down to 15 cm (Bliss 1966). *Agrostis mertensii* does not spread laterally and form turfs like *Carex bigelowii*, but rather forms clumps or tufts (Ketchledge *et al.* 1985). Its ability to spread by vegetative reproduction is therefore limited. It seems to spread primarily through its seeds (SVE Panel 2002). Plants flower from late June to early August (Young 1992). The flowers are wind-pollinated. Fruits form in late August and early September (Young 1992).

The chromosome number of *Agrostis mertensii* is  $2n = 56$  (Gleason and Cronquist 1991). It is an octoploid (Tateoka 1975).

## **HABITAT**

Throughout its range, *Agrostis mertensii* is found on rocky slopes and moist banks at high latitudes and altitudes (Hitchcock 1950). It is found on peaty or rocky soil in the higher mountains of the Northeast (Gleason and Cronquist 1991), where it is characteristic of the drier parts of the dry/mesic alpine heath meadow system. This system is a group of communities that include dry-mesic heath alpine graminoid meadows, fell fields, and an array of *Carex* meadows, strong heaths, diapensia, and barren rock. It is occasionally found in meadows and on bare rock subalpine summits, and although these are not its primary habitats, it can survive and persist in them since they are exposed. Its alpine habitats are characterized by high winds, cold temperatures, ice and snow scour, and soils that are thin, acidic, nutrient-poor, and well-drained (SVE Panel 2002).

In New Hampshire, *Agrostis mertensii* is associated with the Diapensia community and is typically found in habitats of alpine or subalpine rocky summits (Sperduto 1993). It can also be found in the sedge-rush-heath meadow, the dwarf shrub-bilberry-rush barren, the alpine heath snowbank, and the moist alpine herb-heath meadow (Bliss 1963, 1966, community names from Sperduto and Cogbill 1999). Many of these habitats have state ranks of S1 or S2. For more information on ranks, see St. Hilaire (2001). The soils in these habitats have good internal drainage, but tend to stay moist from fog and precipitation. They are acidic, have a low availability of exchangeable cations, and are deficient in nitrogen (Bliss 1966).

1) The Diapensia-azalea-rosebay dwarf shrubland is found on exposed wind blown situations with considerable bare ground where winter snow cover is slight or absent (4400-5500 feet elevation). Diapensia communities are characterized by the lowest percent plant cover of alpine communities (48-51%), a dominance of cushion plants, and a limited cover of lichens and mosses. Freeze-thaw cycles are prevalent, as are active soil polygons (patterned soil movement due to freeze-thaw cycles) (Bliss 1963). Dominant species include *Diapensia lapponica*, *Juncus trifidus*, *Rhododendron lapponicum*, *Loiseleuria procumbens*, and *Vaccinium uliginosum*. Other species may include *Solidago cutleri*, *Salix uva-ursi*, *Agrostis mertensii*, and *Minuartia groenlandica*. Soil pH ranges from 4.2 to 4.6 (Bliss 1963).

2) The sedge-rush-heath meadow is typically found on west and north exposures from 4800-5500 feet and is characterized by mixtures of *Carex bigelowii*, *Juncus trifidus*, dwarf heath and other shrubs (Sperduto 1993). *Minuartia groenlandica* and *Vaccinium vitis-idaea* are present, and total plant cover averages 72% (Bliss 1963). At lower elevations rush-heath mixtures with less sedge are a prominent variant (Sperduto and Cogbill 1999). *Carex bigelowii* is more prominent at higher elevations, while *Juncus trifidus* is more prominent at lower elevations. Other species present include *Potentilla tridentata* and *Cetraria islandica*. Some examples have much exposed rock and may grade into a fellfield community (Sperduto 1993). At elevations above 5600 feet on Mt. Washington, the community is characterized by *Juncus trifidus*, *Vaccinium vitis-idaea*, and *Potentilla tridentata*, with *Carex bigelowii* and *Minuartia groenlandica* decreased in importance. In more exposed areas, *Diapensia lapponica* is common, while *Vaccinium uliginosum* is more prevalent in areas with greater snow cover (Bliss 1963). Soils in this habitat have pHs ranging from 4.0 to 4.7 (Bliss 1963).

3) The dwarf shrub-bilberry-rush barren is found in exposed situations, from 3400 to 4800 feet. It is the most common alpine community type in the Presidential Range of the White Mountains in New Hampshire, covering extensive areas. This community is usually located within a few hundred feet of timberline (Bliss 1963). Some winter snow may accumulate, but it melts early (Sperduto 1993). It is dominated by *Vaccinium uliginosum*, *Vaccinium vitis-idaea*, *Juncus trifidus*, with scattered dwarf shrubs, particularly *Empetrum atropurpureum*, *Potentilla tridentata*, and the occasional *Diapensia lapponica* and *Betula minor*. *Carex bigelowii* and *Juncus trifidus* have a lower abundance here than in sedge-rush-heath meadows (Sperduto and Cogbill 1999). This community type has local variations. On the upper solifluction terraces at higher elevations, like Mt. Washington's Alpine Garden in New Hampshire, *Minuartia groenlandica*, *Scirpus cespitosus*, and *Agrostis mertensii* are important. On nearby Boott Spur and Bigelow Lawn, large stone rings with wind-exposed diapensia communities at their centers are surrounded with dwarf shrub heath-rush or sedge-rush-dwarf shrub heath on the more stable and protected flanks. In areas where the soils are moister in summer, there is an increase in the importance of *Carex bigelowii*, so that it dominates, or is co-dominant with *Juncus trifidus* (Bliss 1963). Soils in this community have pHs that range from 4.1 to 4.6 (Bliss 1963).

4) The alpine heath snowbank community is located in the lee of rocks and ledges or just above continuous krummholz where snow accumulates and typically does not melt until May. Soils in this community tend to be well-drained, with a pH from 4.0 to 4.6 (Bliss 1963). The community is characterized by *Vaccinium uliginosum*, *Vaccinium angustifolium*, *Vaccinium vitis-idaea*, *Carex bigelowii*, and *Juncus trifidus*, supports *Ledum groenlandicum*, *Empetrum nigrum*, *Vaccinium cespitosum*, *Loiseleuria procumbens*, and occasionally *Arctostaphylos alpina* (Sperduto 1993). *Phyllodoce caerulea* and *Harrimanella hypnoides* can be found in this community (Sperduto and Cogbill 1999). Herbaceous associates include *Cornus canadensis*, *Maianthemum canadense*, and *Trientalis borealis*, and *Cetraria islandica* is frequently present. These

communities form dense mats 4 to 12 inches deep, with 91-96% plant cover (Bliss 1963, 1966).

5) The moist alpine herb-heath meadow is found only in the Alpine Garden on Mt. Washington. It was formerly included in the streamside community under Bliss' 1963 classification. It is a moist tundra found near streams or snowbanks that is dominated by a variety of herbs, sedges, and heath shrubs (Sperduto and Cogbill 1999). Shrub and heath species include *Salix planifolia*, *Salix uva-ursi*, *Alnus crispa*, *Salix argyrocarpa*, *Vaccinium cespitosum*, *Vaccinium vitis-idaea*, and *Vaccinium uliginosum*. *Cardamine bellidifolia*, *Carex scirpoidea*, *Saxifraga rivularis*, *Houstonia caerulea*, *Polygonum viviparum*, *Potentilla tridentata*, *Prenanthes nana*, *Scirpus cespitosus*, *Agropyron trachycaulon*, *Trisetum spicatum*, *Veronica alpina*, *Achillea borealis*, *Euphrasia oakesii*, *Epilobium alpinum*, *Viola palustris*, and *Carex capillaris* may all occur (Bliss 1963; Sperduto 1993). Plant cover is typically 90% (Bliss 1963). Soil pH ranges from 4.7 to 4.9 (Bliss 1963).

In Maine, *Agrostis mertensii* is found in the dwarf heath-graminoid alpine ridge community and in open areas of the spruce-fir-birch krummholz community. It is typically found on exposed, open summits. It is associated with *Empetrum nigrum*, *Minuartia groenlandica*, *Juncus trifidus*, *Vaccinium uliginosum*, and a number of other heaths.

6) The dwarf heath-graminoid alpine ridge is the most common community type above treeline in Maine. It occurs on exposed windswept ridges, and ranges from dry in exposed areas to moist in protected patches. The vegetation is a mixture of dwarf evergreen shrubs and herbs, with total cover from 35-65%. The most abundant herbs are *Carex bigelowii* and *Juncus trifidus*. In one variant, *Carex bigelowii* forms carpets and is dominant, with sparse heath shrubs and herbaceous species. *Vaccinium uliginosum* and *Diapensia lapponica* are also present (Gawler 2001).

7) The spruce-fir-birch krummholz community has dense thickets of stunted matted black spruce, balsam fir, and the occasional birch. Other plants do poorly directly under the krummholz, but species such as *Potentilla tridentata* can be found in openings. The krummholz community occurs between subalpine forests and alpine areas on Maine's higher mountains (Gawler 2001).

In Vermont, *Agrostis mertensii* is found in alpine meadows, subalpine krummholz, and on serpentine outcrops. The soils in these communities tend to be poor. All Vermont occurrences are above 3000 feet, and habitat size tends to be small, in part because Vermont does not have extensive alpine habitats.

8) Alpine meadows are found on open, exposed ridgetops at elevations above 3500 feet in Vermont. In these locations, high winds, frequent fog, abundant precipitation, low temperatures, and frequently intense solar radiation are prevalent. The soils are thin and primarily organic, in low pockets and in areas where the bedrock breaks into small fragments through freezing and thawing, allowing soil accumulation. The plant

associations in this community are determined by environmental stresses, soil depth, and moisture. Sedge meadows form a mosaic with low shrub communities, areas of lichen-covered bedrock, and occasional trees in protected pockets. This community is characterized by many arctic species. *Vaccinium uliginosum*, *Empetrum nigrum*, and *Vaccinium boreale* are the dominant shrubs, with *Salix uva-ursi* and *Salix pyrifolia* also present. Herbaceous species may include *Agrostis mertensii*, *Asplenium viride*, *Carex atratiformis*, *Carex bigelowii*, *Deschampsia flexuosa*, *Diapensia lapponica*, *Dryopteris fragrans*, *Empetrum nigrum*, *Hierochloe alpina*, *Huperzia appalachiana*, *Juncus trifidus*, *Luzula parviflora*, *Maianthemum canadense*, *Minuartia groenlandica*, *Poa fernaldiana*, *Potentilla tridentata*, *Prenanthes boottii*, *Smilacina trifoliata*, and *Solidago cutleri* (Thompson and Sorenson 2000).

9) The serpentine outcrop community is sparsely vegetated with low diversity due to the scarcity of soil and the mineral content of the soil. The bedrock may be serpentinite or dunite. Serpentine rock has a high content of iron, magnesium, nickel, and chromium, and a low content of calcium, nitrogen, phosphorus, potassium, and molybdenum. Most of the species found in this habitat are grasses and herbs, though shrubs and occasional trees may be present. Species found in the serpentine outcrop community include *Picea rubens*, *Betula populifolia*, *Juniperus communis* var. *depressa*, *Campanula rotundifolia*, *Cerastium arvense*, *Deschampsia flexuosa*, *Arenaria stricta*, *Dryopteris marginalis*, *Danthonia spicata*, *Poa compressa*, and rarities like *Adiantum viridimontanum*, *Adiantum aleuticum*, *Arenaria macrophylla*, and *Arenaria marcescens* (Thompson and Sorenson 2000).

10) The subalpine krummholz community of Vermont is characterized by stunted trees that are shaped by harsh winds, rime ice, and heavy snowfall. Soils are thin undecomposed organic layers that are near saturation most of the year. The dominant species are *Abies balsamea* and *Picea mariana*, with occasional plants of *Sorbus decora*, *Betula papyrifera* var. *cordifolia*, *Picea rubens*, *Acer spicatum*, and *Sorbus americana* as well. Shrubs include *Vaccinium boreale*, *Vaccinium myrtilloides*, *Vaccinium uliginosum*, *Vaccinium vitis-idaea*, *Ledum groenlandicum*, *Amelanchier bartramiana*, and *Viburnum edule*. The herb layer can include *Maianthemum canadense*, *Cornus canadensis*, *Carex brunnescens*, *Carex canescens*, *Clintonia borealis*, *Oxalis montana*, *Coptis trifolia*, *Potentilla tridentata*, *Pyrola minor*, and *Huperzia appalachiana* (Thompson and Sorenson 2000).

In New York, the Natural Heritage Program (2004) lists its habitat as alpine ridges, meadows, and openings in krummholz. The three community types that correspond to these descriptions according to Edinger et al. (2002) are alpine meadow, alpine krummholz, and spruce-fir rocky summit, and they are described below.

11) The alpine meadow is a meadow community that is similar to arctic tundra. Alpine meadows occur above timberline (about 4900 ft or 1620 m) on the higher mountain summits and exposed ledges of the Adirondacks. This community consists of a mosaic of small grassy meadows, dwarf shrublands, small boggy depressions, and exposed bedrock covered with lichens and mosses. The flora includes arctic-alpine species that

are restricted (in New York) to these meadows, as well as boreal species that occur in forests and bogs at lower elevations. The soils are thin and organic, primarily composed of sphagnum peat or black muck. The soils are often thoroughly wet because they can be saturated by atmospheric moisture from fog. Characteristic species of the grassy meadows include *Scirpus cespitosus*, *Carex bigelowii*, *Calamagrostis canadensis*, *Hierochloa alpina*, *Deschampsia flexuosa*, *Luzula parviflora*, *Juncus trifidus*, *Potentilla tridentata*, *Cornus canadensis*, *Minuartia groenlandica*, and *Prenanthes nana*. Characteristic species of the low shrublands are *Vaccinium uliginosum*, *Chamaedaphne calyculata*, *Ledum groenlandicum*, *Betula glandulosa*, *Empetrum nigrum*, *Rhododendron lapponicum*, *Diapensia lapponica*, and *Salix uva-ursi*. On a few mountains there are distinctive patches of low shrublands consisting of dwarf birches including *Betula glandulosa*, *Betula minor*, and stunted *Betula cordifolia*. Characteristic species of the small boggy depressions include the peat mosses *Sphagnum nemoreum* and *Sphagnum fuscum*, *Eriophorum vaginatum* var. *spissum*, *Kalmia polifolia*, and *Vaccinium oxycoccos*. Rock outcrops that are relatively undisturbed by trampling are covered with arctic-alpine lichens such as map lichen (*Rhizocarpon geographicum*) and may have scattered cushions of diapensia. This community is very sensitive to trampling because of the thin, often saturated soils and the very slow growth rate of the vegetation in the stressful alpine environment. Every effort should be made to minimize off-trail trampling by the many hikers who climb to these meadows in the High Peaks.

12) The alpine krummholz community is a dwarf woodland dominated by *Abies balsamea* that occurs at or near the summits of the high peaks of the Adirondacks at elevations of 3500 to 4900 ft (1067 to 1494 m). Approximately 85% of the canopy consists of *Abies balsamea*; common associates include *Betula cordifolia* and *Picea mariana*. Less common are *Picea rubens*, *Juniperus communis*, *Larix laricina*, and *Thuja occidentalis*. The trees form dense stands of stunted trees; at the uppermost elevations below timberline the trees are under 5 ft (1.5 m) tall, with branches extending to the ground (i.e., there is no self-pruning of lower branches), and an average dbh of 3 in (7.6 cm). The groundlayer is densely shaded; the groundcover consists of a thick carpet of mosses, with scattered lichens and herbs. Characteristic herbs include *Cornus canadensis*, *Solidago macrophylla*, *Oxalis acetosella*, *Coptis trifolia*, and *Maianthemum canadense*.

13) The spruce-fir rocky summit is a community that occurs on cool, dry, rocky ridgetops and summits where the bedrock is non-calcareous (such as anorthosite, quartzite, or sandstone), and the soils are more or less acidic. The vegetation may be sparse or patchy, with numerous rock outcrops and rock slides. The species have predominantly boreal distributions. Characteristic trees include *Picea rubens*, *Abies balsamea*, *Sorbus americana*, and *Betula cordifolia*. *Tsuga canadensis* may be an associate in examples in the Catskill Mountains. The shrub layer includes sapling canopy trees along with *Vaccinium angustifolium* and *Vaccinium myrtilloides*. Characteristic herbs include *Campanula rotundifolia*, *Potentilla tridentata*, *Solidago spathulata* ssp. *randii*, *Solidago macrophylla*, *Deschampsia flexuosa*, *Cornus canadensis*, *Aster acuminatus*, and *Oryzopsis pungens*. There are usually many mosses and crustose lichens growing on rock outcrops. This community type is not fully understood and more data are needed.

In West Virginia, *Agrostis mertensii* occurs on scoured river shores and in roadside ditches. In the Monongahela National Forest, it is known from a grassy shore and from beech and mixed hardwood forests than range in age from 79 to 99 years old. Most occurrences are on Buchanan and Ernest stony soils, though the beech forest is on Dekalb extremely stony moist loam. Elevations range from 2345 to 3887 feet. Associated species in the mixed hardwood forests include *Fagus grandifolia*, *Betula lenta*, *Betula alleghaniensis*, *Acer rubrum*, *Picea mariana*, *Prunus serotina*, *Tsuga canadensis*, *Picea rubens*, *Acer saccharum*, and *Rhododendron* sp.

The alpine and subalpine habitats in which *Agrostis mertensii* occurs overlap with the habitats of *Juncus trifidus*, *Carex bigelowii*, and *Vaccinium uliginosum*, for which conservation assessments have also been written. Surveys in the alpine zone should include these species as well, since they are likely to be found with *Agrostis mertensii*.

## **DISTRIBUTION AND ABUNDANCE**

*Agrostis mertensii* is circumboreal, and in North America is found south to Québec and the higher mountains of Maine, New Hampshire, Vermont, New York, and in the western mountains (Gleason and Cronquist 1991). It is also found in the Central Appalachian region. It is considered common in New England alpine areas (Slack and Bell 1995), perhaps due to its scattered distribution, but is tracked in all northeastern states except New Hampshire. Many occurrences along the Appalachian Trail are not ranked, indicating that there is not a good definition of what constitutes a robust population (A. Schori, Appalachian Trail Conference, personal communication).

### ***Summary of Maine Occurrences***

There are 11 occurrences in Maine Natural Area Program's database (2001). Five of these are historical. Three occurrences have not been observed since 1984. None of the occurrences is from the White Mountain National Forest.

**ME .001 (Dead River Township, Somerset County)** – This occurrence was last seen on August 15, 2002, when it was ranked C. Twenty plants were found, all of them in flower, and were later observed in fruit. The plants were at 3899 feet on damp slides and on dry alpine ledges. Associated species included *Juncus trifidus*, *Minuartia groenlandica*, *Sibbaldiopsis tridentata*, and *Vaccinium* sp. Plants are threatened by hiking. This site is owned by the Bureau of Parks and Land.

**ME .002 (Riley Township, Oxford County)** – This occurrence was last observed on August 7, 1997, when it was ranked C. There were fewer than 10 plants on the east peak, and 10 plants on a bald along a recently constructed trail. The elevation is 3700 feet. The recently constructed trail passes right through rare plant populations, and hiker traffic and erosion threaten the plants. This site is owned by the Bureau of Parks and Land, and the east peak is in the Appalachian Trail Corridor.

**ME .003 (Grafton Township, Oxford County)** – This historical occurrence was last observed in June 1981. Plants were scattered on an exposed rocky summit. The area was surveyed in 1990 but no plants were found. Increased public use has led to erosion and trampling at this site. The elevation is 3800 feet. This mountain is in the Appalachian Trail Corridor and the Mahoosuc Mountain Preserve.

**ME .004 (Kineo Township, Piscataquis County)** – This historical occurrence is based on an 1877 herbarium specimen. A 1986 search of some cliffs failed to find plants. The location is owned by the Mt. Kineo Foundation.

**ME .005 (T3 R10 WELS, Piscataquis County)** – This occurrence was last observed on July 17, 1984, and is considered extant. Plants occurred on an open slide with *Empetrum nigrum*, *Minuartia groenlandica*, *Juncus trifidus*, and *Vaccinium uliginosum*. The elevation was 3260 feet. This location is in Baxter State Park.

**ME .006 (T3 R10 WELS, Piscataquis County)** – This occurrence was last seen on July 18, 1984, and is considered extant. Plants grew on the east knob of a small windswept bald. The elevation was 3710 feet. This site is in Baxter State Park.

**ME .007 (T3 R10 WELS, Piscataquis County)** – This occurrence was last observed on July 16, 1984, and is considered extant. No details are available. The elevation was 3000 feet, and this site is in Baxter State Park.

**ME .008 (Ashland, Aroostook County)** – This historical occurrence is based on a 1900 herbarium specimen. The habitat was given as open woods. Most of Ashland appears to be below 1000 feet.

**ME .009 (T3 R10 WELS, Piscataquis County)** – This occurrence was last observed on August 12, 2000, and is ranked A. Hundreds of plants with immature and mature fruit were found over an extensive area, in gravelly substrate. This site is in Baxter State Park and is owned by the Bureau of Parks and Land.

**ME .010 (T3R10 WELS, Piscataquis County)** – This historical occurrence is based on a 1919 herbarium specimen. The site is in Baxter State Park.

**ME .011 (T5 R9 WELS, Piscataquis County)** – This historical occurrence is based on an herbarium specimen from 1953. The specimen was collected on a ridge in Baxter State Park.

### *Summary of New Hampshire Occurrences*

*Agrostis mertensii* is no longer tracked by New Hampshire Natural Heritage Bureau. The occurrence information below has been patched together from several sources: citations in Pease's 1964 Flora of Northern New Hampshire, scanty Element Occurrence records from New Hampshire Natural Heritage Inventory (2001), including unprocessed reports

and mentions of *Agrostis mertensii* as an associate of other tracked species, and data from the Appalachian Trail Conference's monitoring efforts. Many of the Element Occurrence numbers (all of them from New Hampshire Natural Heritage Bureau) are based on specimens that are cited from Pease, but Pease does not list the exact date or herbarium location of his citations, which presents a challenge when one attempts to match specimens and numbers. Therefore, a discussion of the most likely location and associated specimens is presented where the data did not clearly point to a set of records.

There are at least 13 extant occurrences, and only one of those 13 is outside of the White Mountain National Forest.

**NH .001 (Beans Grant, Coos County)** – This “historical” occurrence is represented by an herbarium specimen from 1894 and one from 1895. Appalachian Trail Conference data report that *Agrostis mertensii* was present here in 1990, so this occurrence should be reranked. It is on land in the Appalachian Trail Corridor and in the White Mountain National Forest.

**Beans Grant, Coos County** – This occurrence was observed on July 7, 1989. *Agrostis mertensii* was noted as an associate of *Carex bigelowii*, along with *Diapensia lapponica*, *Juncus trifidus*, *Potentilla tridentata*, *Empetrum nigrum*, *Minuartia stricta*, and *Solidago cutleri*. The elevation is 3910 feet. This site is in the White Mountain National Forest and the Appalachian Trail Corridor, and does not have an occurrence number or rank.

**NH .002 (Sargents Purchase, Coos County)** – This occurrence was first seen in a ravine in 1898 and is represented by an herbarium specimen (see note under NH .005). Pease (1964) also lists herbarium specimens from 1885, 1895, 1901, and 1926 for this location. This occurrence was last observed on July 18, 1990, but no details were recorded and it is unranked. There is an unprocessed report for this location at New Hampshire Natural Heritage Bureau. This site is in the White Mountain National Forest.

**NH .003 (Sargents Purchase, Coos County)** – This “historical” occurrence is based on herbarium specimens from 1885 and 1933. Appalachian Trail Conference data indicate that *Agrostis mertensii* was seen and ranked B at a certain gulf in 1990 (no details recorded), but the “last observed” date was listed as 1933. On the basis of the 1933 date, it is presumed that plants observed by New Hampshire Natural Heritage Bureau in 1999 at the same gulf are part of the same occurrence. They were noted as an associated species of *Arnica lanceolata* along with *Veratrum viride*, *Symphyotrichum novi-belgii*, *Geum peckii*, *Alnus viridis* ssp. *crispa*, *Minuartia groenlandica*, *Salix planifolia*, *Platanthera dilatata*, *Calamagrostis canadensis*, and *Trichophorum cespitosum*. The elevation is 4825 feet, and this location is in the White Mountain National Forest.

**NH .004 (Thompson & Meserve, Coos County)** – This “historical” occurrence is based on an 1882 herbarium specimen. Based on the citations in Pease (1964), it is presumed that the 1882 collection is from the same gulf as specimens collected in 1895, 1896, and 1897. There is also an 1886 specimen from a peak at the top of this gulf. Appalachian Trail Conference data list *Agrostis mertensii* is listed as present in this gulf in 1990 but as

“last observed” in 1882. *Agrostis mertensii* was observed on this gulf in 1994 as an associated species of *Deschampsia atropurpurea*, along with *Deschampsia flexuosa*, *Thelypteris phegopteris*, *Viola* sp., *Streptopus amplexifolius*, *Solidago macrophylla*, *Carex brunnescens*, *Luzula parviflora*, *Alnus crispa*, *Geum peckii*, *Juncus trifidus*, and *Betula cordifolia*. The elevation was 2690 feet. The plants grew on mossy boulders and outcrops in the White Mountain National Forest.

**NH .005 (Sargents Purchase, Coos County)** – This historical occurrence is based on herbarium specimens collected in 1890 and 1898. It appears to be closely associated with NH .002, which is also based on an 1898 specimen by the same collector. Pease (1964) only lists one Eggleston collection from 1898, from a ravine. As for the 1890 date, Pease lists a collection from lakes above the head of the ravine, as well as collections from 1896. New Hampshire Natural Heritage Bureau data place NH .005 at the lake location. Therefore it appears as if Pease’s 1898 citation belongs to NH .002. The elevation of the lake is 5020 feet. This site is in the White Mountain National Forest.

**NH .006 (Sargents Purchase, Coos County)** – This historical occurrence is known from herbarium specimens collected in 1901 and 1928. It was last observed in 1960, when an herbarium specimen was also collected. This location is at 6280 feet and is in Mt. Washington State Park and the White Mountain National Forest.

**NH .007 (Low & Burbanks, Coos County)** – This “historical” occurrence is based on herbarium specimens from 1884 and 1886. Plants were seen in this ravine in 1990 during an Appalachian Trail Conference monitoring trip, so this occurrence will have to be reranked. The elevation is 5020 feet. This site is in the White Mountain National Forest.

**NH .008 (Franconia, Grafton County)** – This historical occurrence is based on a 1915 herbarium specimen. St. Hilaire (2001) indicated that this occurrence was not on land owned by the White Mountain National Forest.

**Franconia, Grafton County** – There are three unprocessed reports at New Hampshire Natural Heritage Bureau for *Agrostis mertensii* at locations near NH .009. One population was observed on an alpine cliff in 1994. It was listed as an associated species of *Poa fernaldiana*. The elevation was 4800 feet. There are no details for the other occurrences. All of them are within the White Mountain National Forest, and will either be assigned separate Element Occurrence numbers or be considered part of NH .009.

**NH .009 (Franconia, Grafton County)** – This occurrence was first seen in 1915 and is represented by an herbarium specimen. It was seen again on August 25, 1990, and noted as abundant, in several scattered locations. This occurrence is ranked A. There is an unprocessed report for this location at New Hampshire Natural Heritage Bureau. The site is in the Appalachian Trail Corridor and the White Mountain National Forest.

**NH .010 (Sargents Purchase, Coos County)** – This historical occurrence is based on herbarium specimens from 1881, 1882, 1885, and 1907. The site was surveyed in 1985 and 1990 but no plants were found. The elevation is 5250 feet. This location is in the

White Mountain National Forest.

**NH .011 (Benton, Grafton County)** – This occurrence was observed on July 31, 1990. It was noted as being relatively small but in excellent condition, and is ranked B. It was also observed on October 6, 2002. Associated species included *Carex bigelowii*, *Potentilla tridentata*, *Minuartia groenlandica*, *Deschampsia flexuosa*, *Vaccinium uliginosum*, *Vaccinium vitis-idaea*, *Juncus trifidus*, and *Achillea millefolium*. The elevation is 4800 feet. This mountain is in the Appalachian Trail Corridor and is monitored by the Appalachian Trail Conference. It is partly owned by the White Mountain National Forest. There is an unprocessed report for this location at New Hampshire Natural Heritage Bureau.

**NH .012 (Franconia, Grafton County)** – This occurrence was seen on August 7, 1990. It is ranked CD because of limited habitat. It is a rocky summit with an acre of alpine habitat at 4360 feet. It is in the White Mountain National Forest. This site is monitored by the Appalachian Trail Conference. Hiker traffic has an impact on plants.

**NH .013 (Chandlers Purchase, Coos County)** – This occurrence was last observed on July 5, 1990. No detailed notes were taken. There are a variety of alpine habitats present, including a summit dominated by *Diapensia lapponica*, *Carex bigelowii*, and *Juncus trifidus*, and a subalpine bog. The elevation is 4127 feet. This site is in the Presidential Range-Dry River Wilderness Area of the White Mountain National Forest, and is also in the Appalachian Trail Corridor. This species is monitored by the Appalachian Trail Conference.

**NH .015 (Albany, Carroll County)** – This occurrence was observed on August 6, 1991. There were modest or small populations in disturbed open areas. They occurred in scattered stations on summit areas, but were nowhere abundant. The habitat was identified as Northern New England Acidic Rocky Summit/Rock Outcrop community, and associated species included *Empetrum atropurpureum*, *Vaccinium uliginosum*, *Calamagrostis stricta* ssp. *inexpansa* v. *lacustris*, and *Calamagrostis canadensis* v. *robusta*. This occurrence is ranked C. This location is in the White Mountain National Forest.

**NH .016 (Dixville, Coos County)** – This historical occurrence is based on a 1917 herbarium specimen from the Notch. It could have been from private land or Dixville Notch State Park.

**NH .017 (Second College Grant, Coos County)** – This historical occurrence is based on two herbarium specimens, one from 1914 and one from 1952. The location is a pair of small rock outcrops on either side of a river. The site is owned by an educational institution.

**NH .018 (Low & Burbanks, Coos County)** – This historical occurrence is based on a 1915 herbarium specimen. Pease places what is presumed to be this specimen from a waterfall along a trail, not too distant from the specimens on the ridge below NH .019.

**NH .019 (Low & Burbanks, Coos County)** – This historical occurrence is based on herbarium specimens from 1884 and 1901. The elevation was approximately 4725 feet. This location is in the White Mountain National Forest. Two other herbarium specimens, both from 1909, represent collections from the ridge below this mountain.

**NH .022 (Sargents Purchase, Coos County)** – This historical occurrence is based on an 1878 herbarium specimen from a ravine. The elevation was 3643 feet. This location is in the White Mountain National Forest.

**NH .023 (Sargents Purchase, Coos County)** – This historical occurrence is based on a 1948 herbarium specimen from a trail in the Presidential Range. The site is in the White Mountain National Forest.

**NH .024 (Sargents Purchase, Coos County)** – This historical occurrence is based on an 1893 collection from a peak. The elevation is 4921 feet, and the site is in the White Mountain National Forest.

**NH .025 (Sargents Purchase, Coos County)** – This historical occurrence is based on collections from 1882, 1885, and 1887. The specimens are identified as being from a well-known trail and in Cutts Grant, but the trail does not run through Cutts Grant. New Hampshire Natural Heritage Bureau places this occurrence in Sargents Purchase instead. The elevation is 4780 feet, and this site is in the White Mountain National Forest.

**NH .026 (Thompson & Meserve, Coos County)** – This historical occurrence is based on an 1895 herbarium specimen that was collected at ‘Mike’s House.’

**Stratford, Coos County** – There is an unprocessed report at New Hampshire Natural Heritage Bureau for *Agrostis mertensii* at a mountain in the Vickie Bunnell Tract, which is owned by The Nature Conservancy. This is a new occurrence and has not been assigned a number or rank.

### ***Summary of Vermont Occurrences***

There are four extant occurrences in Vermont (Vermont Nongame and Natural Heritage Program 2001). One of them is on land owned by the Green Mountain National Forest.

**VT .001 (Lowell, Orleans County)** – This occurrence was first seen in 1981 and is on land owned by the Vermont Department of Forest, Parks & Recreation. In 1991, a small healthy population was observed. This occurrence was last observed on June 15, 1999. One large clump was observed in flower. The site was described as a NNE serpentine outcrop community in the crevices and shelves of a sheer cliff of the knob just below the summit. The elevation is 3223 feet.

**VT .002 (Stowe, Lamoille County)** – This occurrence was last observed on July 14, 1990. It is on the summit of a mountain and is recorded as common in alpine tundra areas, widespread on the summit, and is ranked A. The elevation is 3900 feet. The owner is the University of Vermont.

**VT .006 (Lincoln, Addison County)** – This occurrence was last observed on July 8, 1989. Plants were searched for but not found in 2002. The occurrence was at the summit of a mountain along the Long Trail. Three plants with mature fruit were found in subalpine fir-heath krummholz that consisted of a mosaic of bare rock and stunted balsam fir, low heaths and mats of low herbaceous vegetation. The elevation is 4000 feet. This occurrence was ranked E, and the site is owned by the Green Mountain National Forest. A specimen appears to have been collected to verify its identification as *Agrostis mertensii*.

**VT .007 (Worcester, Washington County)** – This occurrence was last observed in 1989. Twenty plants were found in an area of a few square meters, in turf dominated by *Deschampsia flexuosa* and *Carex brunnescens*. The habitat is the ledgy schist summit of a mountain, at an elevation of 3490 feet. The mountain is in CC Putnam State Forest, which is owned by the Vermont Department of Forests, Parks & Recreation.

### *Summary of New York Occurrences*

There are 10 extant and 3 historical occurrences in New York, all of which are from Adirondack Park (New York Natural Heritage Program 2004).

**NY .002 (Keene, Essex County)** – This occurrence was last seen on July 6, 1949. The site was surveyed on August 2, 1988. Plants occurred near the summit of a mountain, at 4870 feet. The occurrence is based on a 1949 specimen and has a rank of F. It is in the High Peaks Wilderness Area of Adirondack Park.

**NY .003 (North Elba, Essex County)** – This occurrence was last seen on June 30, 1958. Plants were observed but not collected. It is in Adirondack Park and is owned by the Adirondack Mountain Club. The occurrence is considered historical.

**NY .004 (Keene, Essex County)** – This occurrence was last seen on July 23, 1961. It is considered historical and is based on a specimen from a mountain in Essex County. There are two mountains with the same name, and this occurrence was mapped onto the one in the High Peaks Wilderness Area of Adirondack Park.

**NY .005 (Keene, Essex County)** – *Agrostis mertensii* was collected from this site in 1892, 1906, 1917, and 1921. The occurrence was surveyed on July 22, 1989, and it was last seen in July 2001. The habitat is alpine meadows and krummholz at 4500-5320 feet elevation. Associated species include *Vaccinium uliginosum*, *Vaccinium boreale*, *Empetrum nigrum*, *Carex bigelowii*, *Diapensia lapponica*, and *Scirpus cespitosus*. There are 15 acres of suitable habitat. *Agrostis mertensii* was found on the summit of the

mountain in grassy areas and along paths in the krummholz. The occurrence is ranked A and is in the High Peaks Wilderness Area of Adirondack Park.

**NY .060 (Keene, Essex County)** – This occurrence was first documented by a specimen collected in 1944. It was first surveyed on August 23, 1988, and was last observed on July 29, 1995, when another specimen was collected. Plants occur on a broad north-south ridge that has areas of bare rock, a strip of alpine meadow, and scattered krummholz. The elevation is 4695 feet. It is in the High Peaks Wilderness Area of Adirondack Park. The occurrence is ranked Extant.

**NY .070 (North Elba, Essex County)** – This occurrence is known from specimens collected in 1868, 1923, and 1930, was last observed in July 2001, and has not been surveyed. Plants are on the summit of a peak, at an elevation of 5000 feet. The occurrence is in the High Peaks Wilderness Area of Adirondack Park and is owned by the New York State Department of Environmental Conservation. It is ranked Extant.

**NY .080 (Keene, Essex County)** – This occurrence was first surveyed on August 12, 1988, and was last observed on August 16, 2001. The habitat is a narrow band of krummholz and alpine meadows on the summit of a mountain. The elevation is 4760 feet. It is in the High Peaks Wilderness Area of Adirondack Park. It is ranked Extant.

**NY .090 (North Hudson, Keene, Essex County)** – This occurrence was first known from a 1951 herbarium specimen. It was first surveyed on July 9, 1989, and was last observed on September 12, 2001. Plants grow on the alpine ledges at the summit of a mountain. There is one acre of habitat at 4820 feet elevation. This occurrence is in Adirondack Park. It is ranked Extant.

**NY .010 (Wilmington, Essex County)** – Specimens from this location were collected in 1870, 1894, 1899, and 1917. It was first surveyed on June 17, 1986, and was last observed on July 21, 1999. Plants grew below the open summit at the top of the trail to Wilmington turn. *Agrostis mertensii* is found in open areas between fir trees, along the trail and among rocks, mostly in moss. Associated species are *Minuartia groenlandica*, *Abies balsamea*, and *Vaccinium uliginosum*. The elevation is 4700 feet. An acre of suitable habitat is present. The occurrence is identified as a small population in good habitat and is ranked B. The occurrence is in the Whiteface Mountain Ski Center in Adirondack Park.

**NY .011 (Keene, Essex County)** – This occurrence was first collected on July 30, 1958. It was first surveyed on July 27, 1989, and was last observed on August 11, 2001. Plants occur on the summits and in the alpine zone and krummholz of two adjacent mountains. The area is a north-south ridge with an extensive alpine area. This is a large population for New York, with 21 acres of suitable habitat. The elevation is 4775 feet. This occurrence is ranked B and is in the High Peaks Wilderness Area of Adirondack Park.

**NY .012 (North Elba, Essex County)** – This occurrence was first surveyed on July 16, 1989, and last observed on July 31, 2001. Plants are found in the alpine zone of a peak.

The habitat is identified as good, with large bedrock exposures, and covers 5 acres at 4475 feet elevation. The occurrence is ranked BC and is in the High Peaks Wilderness Area of Adirondack Park.

**NY .013 (Keene, Essex County)** – This occurrence was last observed and surveyed on July 30, 1989. Plants are scattered in an alpine meadow at the summit of a mountain. The rocky alpine summit has *Vaccinium uliginosum*, *Solidago cutleri*, *Scirpus cespitosus*, and *Empetrum nigrum*. There is one acre of habitat at 3550 feet elevation. The occurrence is ranked C due to the small population, limited habitat, and the proximity of a busy hiking trail. It is in the Dix Mountain Wilderness Area of Adirondack Park.

**NY .014 (North Elba, Essex County)** – This occurrence was last observed on September 27, 2001. Plants are on the summit of the peak northwest of a peak. The occurrence has not been surveyed and is ranked as Extant. It is in the High Peaks Wilderness Area of Adirondack Park, and is owned by the New York State Department of Environmental Conservation.

### *Summary of West Virginia Occurrences*

West Virginia Natural Heritage Program (2004) tracks 5 occurrences, one of which is historical. The other four occurrences are identified as within Monongahela National Forest (West Virginia Natural Heritage Program (2004)). Monongahela National Forest tracks 7 occurrences, two of which are on private land (M. Thomas-Van Gundy, personal communication). The two Monongahela National Forest occurrences that are not tracked by the state are listed separately.

Land in West Virginia is delimited with the metes and bounds system, rather than the township and range system used in northern states such as Maine. Therefore, West Virginia locations refer to county and quad rather than county and township, since township names were not available for the following locations.

**WV .001 (Spruce, Pocahontas County)** – This historical occurrence was first and last seen on August 2, 1928. It is known from a specimen that was collected on a railroad track on a mountain at an elevation of 3800 feet (West Virginia Natural Heritage Program 2004). According to Monongahela National Forest data (M. Thomas-Van Gundy, personal communication), the location is an alluvial riparian forest at 3887 feet. Spruce was a logging town that was abandoned decades ago. It is privately owned.

**WV .002 (Randolph County)** – A specimen was collected at this site in June 1964. This occurrence was last seen in July 1983. One station was found at a bridge on the west bank of a stream, 10 yards above the mouth of another stream. The occurrence is ranked E (West Virginia Natural Heritage Program 2004). The site is a 94 year old mixed hardwood forest at 3549 feet. Since it is next to a stream it would be protected during active management by riparian area guidelines. Associated species include *Picea rubens*, *Acer rubrum*, *Betula alleghaniensis*, and *Rhododendron* sp. It is on land owned by

Monongahela National Forest. The area is managed for remote habitat suitable for wildlife intolerant of disturbance (M. Thomas-Van Gundy, personal communication).

**WV .003 (Randolph County)** – This occurrence was last seen on June 27, 1989. A population was found in flower and fruit at the mouth of a hollow. This occurrence is ranked E (West Virginia Natural Heritage Program 2004). The site is a grassy area at 3726 feet. It is next to a stream and would be protected during active management by riparian area guidelines. It is on land owned by Monongahela National Forest. The area is managed for remote habitat suitable for wildlife intolerant of disturbance (M. Thomas-Van Gundy, personal communication).

**WV .004 (Snyder Knob Quad, Randolph County)** – This occurrence was last seen on July 13, 1989. A population was found along a stream between two other streams. Data appear to be taken from an herbarium specimen that contained a fruiting plant. The habitat was a scoured riverbank with grasses, *Juncus*, *Carex*, *Solidago*, *Hypericum*, *Agrostis hyemalis*, *Agrostis scabra*, *Agrostis alba*, and other species. It was a flat, open site on moist sand and gravel, with several acres of potential habitat in the area. There were no threats and no evidence of disturbance, and the habitat, viability, and defensibility of the site were rated as excellent (West Virginia Natural Heritage Program 2004). This occurrence is from a 79 year old mixed hardwood forest at 3677 feet. Since it is next to a stream it would be protected during active management by riparian area guidelines, but it is also near a road and management may occur in the future to restore drainage, block access, or return the roadbed to contour. Associated species include *Fagus grandifolia*, *Betula* sp., *Acer saccharum*, *Acer rubrum*, *Picea rubens*, and *Prunus serotina*. It is on land owned by Monongahela National Forest. The area is managed for remote habitat suitable for wildlife intolerant of disturbance (M. Thomas-Van Gundy, personal communication).

**WV .005 (Snyder Knob Quad, Randolph County)** – This occurrence was last seen in July 1989. The site was at the intersection of two streams, at the edge of a spruce-northern hardwood forest. Data come from an herbarium specimen of a plant with mature fruit. The location appears to be an open wet ditch next to a road above Shavers Fork. The only associated species identified was *Agrostis alba* (*Agrostis gigantea*). No threats were identified and the occurrence is not ranked (West Virginia Natural Heritage Program 2004). According to Monongahela National Forest data (M. Thomas-Van Gundy, personal communication), this occurrence is in a 99 year old beech forest at 3834 feet. It is on land owned by Monongahela National Forest and is near a road, so management may occur in the future to restore drainage, block access, or return the roadbed to contour. The area is managed for remote habitat suitable for wildlife intolerant of disturbance.

**MNF E** – This occurrence is from an 84 year old mixed hardwood forest at 2863 feet. Associated species include *Fagus grandifolia*, *Betula lenta*, *Betula alleghaniensis*, *Prunus serotina*, *Tsuga canadensis*, *Acer rubrum*, *Acer saccharum*, and *Rhododendron* sp. It is on land owned by Monongahela National Forest. The area is managed for

hardwood timber products and habitats for wildlife tolerant of human disturbance (M. Thomas-Van Gundy, personal communication).

**MNF F** – This occurrence is from 2345 feet and is on private land. It is next to a road (M. Thomas-Van Gundy, personal communication).

## **STATUS**

*Agrostis mertensii* has a global rank of G5, indicating that it is secure. There is no available information about its status outside of North America. It is ranked S1 in Vermont, and West Virginia. It is ranked S2, T in Maine, S2 in New York, and is ranked S3 in New Hampshire. Table 1 shows the status of *Agrostis mertensii* in North America by state and province.

**Table 1. Status of *Agrostis mertensii* in North America (NatureServe 2001).**

<b>RANKED as S1, S2 or LISTED as T or E by State</b>	<b>RANKED as S3-S5 or S? or SU</b>	<b>RANKED as SR or SRF</b>	<b>RANKED as SH or SX</b>
Maine (S2, T): 6 extant and 5 historical occurrences	New Hampshire (S3): 13+ extant and 13 historical occurrences	Alaska (SR); Colorado (SR); Utah (SR)	
Vermont (S1): 4 extant occurrences	Montana (SU)	Northwest Territories (SR)	
New York (S2): 10 extant and 3 historical occurrences	British Columbia (S?)	Nunavut (SR)	
North Carolina (S1)	Labrador (S3S5); Newfoundland Island (S3S5)	Quebec (SR)	
Tennessee (S1)	Manitoba (S3)	Yukon (SR)	
Washington (S1?)	Nova Scotia (SU)		
West Virginia (S1): 4-6 extant occurrences and 1 historical occurrence	Ontario (S3)		
Wyoming (S1)			
Alberta (S2)			
New Brunswick (S1)			
Saskatchewan (S1S2)			

In New Hampshire, there are 26 occurrences of *Agrostis mertensii* in the New Hampshire Natural Heritage Bureau database. Of those, 13 are historical. Twenty-one occurrences are from within the White Mountain National Forest, and 9 of those are historical. In Vermont, there are 4 extant occurrences, one of which is from the Green Mountain National Forest. In Maine, there are 11 occurrences, 5 of which are historical. None is from the White Mountain National Forest. In West Virginia, there are 5-7 occurrences, 4-5 of which are from Monongahela National Forest.

*Agrostis mertensii* is on the Regional Forester's Sensitive Species list for the Green Mountain and Monongahela National Forests. It is listed as a New England Plant Conservation Program Division 2 species, indicating that it is a regionally rare taxon with 20 or fewer occurrences in New England (Brumback and Mehrhoff *et al.* 1996). If New

Hampshire updates its records to reflect the rediscovery of several historical occurrences, *Agrostis mertensii* might eventually be changed to a Division 3 species.

## **POPULATION BIOLOGY AND VIABILITY**

*Agrostis mertensii* is a short-lived perennial that lives four years per generation (Kurchenko 1991). Since it forms dense clumps, the clump can persist for years after the original shoot has died. *Agrostis mertensii* cannot colonize large areas in the same way as a rhizomatous plant like *Carex bigelowii*, but it does colonize its local area. It can occupy small patches of habitat, and can spread over large areas as well (SVE Panel 2002). *Agrostis mertensii* seems to rely on seed dispersal as its primary means of moving around and colonizing new habitat (SVE Panel 2002). This would indicate that it has fairly good seed set, germination success, and seedling establishment, though small population sizes on the Green Mountain National Forest might suggest otherwise. It is successfully dispersed, perhaps by wind or animals, and can be widespread in suitable habitat (SVE Panel 2002). If habitat remains available, and populations are not affected by trampling or changing climatic conditions, *Agrostis mertensii* will remain a widespread species in the Northeast.

## **POTENTIAL THREATS AND MONITORING**

### **Present or Potential Risks to Habitat or Range**

Alpine habitat in New England and New York is threatened by hiker traffic. Erosion is a concern in areas where soils rebuild very slowly. Trail construction and use have eliminated or threatened some areas of alpine habitat (SVE Panel 2002). Trampling by hikers is the primary threat to the dry/mesic alpine heath meadow system. The system is widespread, but trampling by trails along ridges, peaks, and vista areas on lesser summits and ridges, where habitat patches are smaller, may put *Agrostis mertensii* and associated species at risk (SVE Panel 2002).

Alpine forests and summits may be threatened by pollution and climate change. It is possible that global warming could cause the extirpation of some alpine species along the southern portions of their ranges (Zika 1993). Global warming could also cause changes in precipitation patterns that could affect moisture regimes and change the structures of some alpine community types. Air pollution could negatively affect some species, especially in the form of ground-level ozone, which damages plant tissues. Acid rain deposition is not likely to be a big issue since alpine soils are already quite acidic (SVE Panel 2002).

Ketchledge and Leonard (1984) reported that in their 24 year study on Mt. Marcy, there was no significant change in the alpine meadow where they had located a permanent transect far from the public hiking trail and free from trampling versus the severe

deterioration along the public hiking trail several hundred feet upslope (and out of sight of the study area).

### **Commercial, Recreational, Scientific or Educational Over-utilization**

Recreational over-utilization of summits is perhaps the most imminent threat to populations of *Agrostis mertensii*. Hiker traffic on many alpine summits in the Northeast is very heavy, and hikers are not always aware of the plants they may be walking over or sitting on. Over-use can impact plants directly, and can also cause a significant loss of habitat due to soil compaction and erosion, both of which can lead to the extirpation of populations. *Agrostis mertensii* is a perennial, but not a long-lived perennial, and without sufficient available habitat to colonize, small populations will probably become extirpated. It prefers some degree of disturbance, but too much disturbance can eliminate habitat. *Agrostis mertensii* is not threatened by commercial, scientific, or educational uses.

### **Disease or Predation**

There are no reports of disease or predation being a threat to *Agrostis mertensii*. It is possible that increased stress from drought or temperature increases could make plants more vulnerable to attacks by predators and pathogens. Plants may be occasionally picked by hikers, but are probably likely to be discarded in suitable habitat, where viable seed could become established.

### **Inadequacy of Existing Regulatory Mechanisms**

*Agrostis mertensii* is not a protected species in Maine or New Hampshire. Though it is on the state list in Maine, it is not afforded any protection (D. Cameron, MNAP, personal communication). Small populations could easily be lost due to recreational impacts. There are no regulations that restrict recreational impacts, except in Maine's Baxter State Park, where access is somewhat restricted. In Vermont, species that are state listed as Threatened or Endangered are protected from "taking" (picking, digging up, etc.) without a permit (R. Popp, Vermont Nongame and Natural Heritage Program, personal communication). However, *Agrostis mertensii* is not state listed, and the protection from taking does not include protection from trampling by hikers. On peaks in the Green Mountain National Forest, there are no regulations that prohibit fires and camping above treeline, activities which could negatively impact plants and habitat. In New York, plants on the state list are protected from "taking" without the landowner's permission (New York Natural Heritage Program 2004). Plant protection laws can be very difficult to enforce. In West Virginia, occurrences that are next to roads may be impacted by road maintenance, even though the species is on the Regional Forester's Sensitive Species list and is protected.

In addition, there are no regulatory mechanisms that protect habitat. Efforts are being made in the White and Green Mountains to educate hikers and limit hiker impacts, but there are very few regulations that are effective at preventing habitat loss. Federal

regulations governing air pollution and air quality are also not effective at preventing damage to alpine plants and ecosystems from ozone and other pollutants.

### **Other Natural or Human Factors Affecting Continued Existence of Species**

*Agrostis mertensii* is primarily a species of open habitats. It needs some level of disturbance to maintain openings and is most abundant in areas where frost heaving creates open soil (Bliss 1963). It may be found in open areas of heath or krummholz communities, but succession may be responsible for eliminating small populations as open areas grow in. There is some concern over the impact of dogs on alpine vegetation in Vermont. In West Virginia, the species is found on open river banks. The open habitat there is maintained by river scour. If scouring regimes change, the populations could decline or become extirpated.

### **SUMMARY OF LAND OWNERSHIP AND EXISTING HABITAT PROTECTION**

In Maine, most of the occurrences are on land owned by the Bureau of Parks and Lands or Baxter State Park. Habitat in Baxter State Park and in the Appalachian Trail Corridor is protected from development, though not from recreational impacts. Land owned by the Bureau of Parks and Land is managed for multiple uses, including recreation, wildlife, and timber. Their dominant use system is designed to keep intensive management activities away from areas with rare species and backcountry recreational usage (Maine Bureau of Parks and Land 2004). Land owned by private individuals and companies is assumed to be without protection.

In New Hampshire, all but five occurrences are within the White Mountain National Forest. *Agrostis mertensii* is not on the Regional Forester's Sensitive Species list for the White Mountain National Forest. *Agrostis mertensii* does not grow in forested habitats, so logging on the White Mountain National Forest is not a threat. Ten occurrences are within the Appalachian Trail corridor, and so are technically protected. The alpine zone is primarily a recreational concern, and is not protected from recreational over-use. One occurrence is on land owned by The Nature Conservancy and so is afforded some measure of protection, though logging may occur in the area.

In Vermont, two occurrences are owned by the Vermont Department of Forest, Parks & Recreation, one is owned by the University of Vermont, and the other is owned by the Green Mountain National Forest. Since *Agrostis mertensii* is on the Green Mountain National Forest Regional Forester's Sensitive Species list, any activities near the occurrence should maintain protection for the plants. There is also a summit steward at the Green Mountain National Forest site who encourages people to stay off the alpine vegetation. The Vermont Department of Forests, Parks & Recreation lands are protected from development. Land classified as natural areas are managed for protection of rare species and habitats and for recreational purposes (Vermont Department of Forests, Parks, and Recreation 2004). The University of Vermont allows multiple uses of its land but cooperates with state agencies to protect the alpine habitat. Vermont's alpine

summits are heavily used by hikers, and also are used by radio stations and ski resorts. Illegal ski trails tend to be a problem. These may not threaten *Agrostis mertensii*, but they illustrate that effective habitat protection can be limited.

In New York, all occurrences are in Adirondack Park. Adirondack Park is a combination of public and private lands that is managed for multiple uses, including water conservation and timber management. Some areas are designated as wilderness or as for outdoor recreation. All public lands are managed by the state, and there is a management plan for the whole Park. The Adirondack Park Agency is responsible for managing the Park (Adirondack Park Agency 2004). It is not clear which occurrences in Adirondack Park are on public lands, and it is not clear what the management strategy for the alpine areas is. Two occurrences in the Park are on land owned by the New York State Department of Environmental Conservation. Since the Department of Environmental Conservation is responsible for setting and enforcing environmental laws, including New York's protected plants legislation, it is assumed that populations of *Agrostis mertensii* on Department of Environmental Conservation lands are afforded protection. One occurrence is owned by the Adirondack Mountain Club. Again, recreational uses are heavy, and ski resorts expansion may threaten some occurrences.

In West Virginia, four to six occurrences are owned by Monongahela National Forest. The other occurrence(s) is (are) privately owned. *Agrostis mertensii* is on the Regional Forester's Sensitive Species list of sensitive species, and the Forest tries to avoid activities around occurrences. Populations along river shores are protected from logging by riparian corridor buffer restrictions, but populations near roads may be impacted by road management (M. Thomas-Van Gundy, Monongahela National Forest, personal communication).

### **SUMMARY OF EXISTING MANAGEMENT ACTIVITIES**

There are no existing management activities in Maine, New Hampshire, the White Mountain National Forest, or Monongahela National Forest. The National Forests have management plans in place or are in the process of developing them. The Appalachian Trail Conference monitors rare plants within its corridor and tries to protect rare plants during trail work. There may be management activities in Adirondack Park, on lands owned by the New York Department of Environmental Conservation, and on lands owned by the Vermont Department of Forests, Parks, and Recreation. There are management plans in place for their lands, but no information on management activities was available through those agencies' websites or through data provided by Natural Heritage Programs. Current management activities in Vermont appear to be restricted to periodic monitoring by the Green Mountain National Forest and the conservation activities of the Green Mountain Club. See below for details.

### **PAST AND CURRENT CONSERVATION ACTIVITIES**

In Maine, Vermont, New York, and West Virginia, *Agrostis mertensii* is tracked by state Natural Heritage Programs. Signs aimed at educating visitors about the fragility of the alpine zone are present on various peaks in Maine, New Hampshire, Vermont, and New York. Alpine revegetation projects have been carried out at a small scale in the Adirondacks (Ketchledge *et al.* 1985), but may not be occurring presently.

The Green Mountain Club is responsible for a number of conservation activities. Summit caretakers are present on Mt. Mansfield, Camel's Hump, and Mt. Abraham from the end of May to mid-October to educate visitors about alpine habitats and plants. Trail crews work to keep trails well-defined with blazes and cairns, and construct scree walls to protect vegetation. Summit caretakers also use string to mark off areas that are being revegetated, and position wooden signs that ask people to stay off revegetated areas at ground level, where they can be easily seen. Illegal trails and areas used repeatedly for picnicking or view seeking are revegetated. The Green Mountain Club's conservation activities are limited by a lack of funds to pay caretakers and varying regulations for lands owned by different agencies.

## **RESEARCH AND MONITORING**

### **Existing Surveys, Monitoring and Research**

In Maine, there is no regularly scheduled monitoring for *Agrostis mertensii*. It is not actively surveyed or monitored in New Hampshire and the White Mountain National Forest. The Appalachian Mountain Club monitors vegetation and rare species around its huts, but *Agrostis mertensii* is not a targeted species. In New Hampshire, other surveys in the alpine area are carried out by New England Plant Conservation Program task force members, although those surveys tend to target the rarest alpine species, and by Plant Conservation Volunteers, who are overseen by the New England Wild Flower Society. *Agrostis mertensii* is not a high priority because it is not tracked in New Hampshire. The Appalachian Trail Conference last conducted surveys within its trail corridor in 1990, and *Agrostis mertensii* was noted as present in some areas (A. Schori, personal communication). The species is no longer tracked by New Hampshire Natural Heritage Bureau. There appears to be no present research on *Agrostis mertensii* in New Hampshire or Maine.

In Vermont, monitoring and surveys are conducted by Vermont Nongame and Natural Heritage Program botanists and by Plant Conservation Volunteers. There is no regular scheduling for surveying activities (R. Popp, personal communication). Monitoring on the Green Mountain National Forest property is organized by New England Plant Conservation Program task force members in coordination with the Green Mountain National Forest. This site is surveyed every few years, most recently in 2002 (M. Deller, personal communication). There are several long-term study transects that have been set up on Mt. Mansfield to monitor vegetation changes.

In New York, monitoring and surveys are conducted by New York Natural Heritage Program botanists. There have previously been revegetation studies in the alpine zone of the Adirondacks, but there may not be any current studies.

In West Virginia, the state Heritage Program surveys the *Agrostis mertensii* populations. Monongahela National Forest is not currently monitoring its populations, and it has not received any requests for research permission.

### **Survey Protocol**

Each state's Natural Heritage Program has its own form for surveys, but all the forms are designed to gather the same basic information. Location, population size, habitat, and threats are all important. New Hampshire's old form asked for detailed information on habitat (community type, associated species, slope, aspect, position, soil hydrology), population data (number of ramets or genets if countable, occurrence area, plant health, population structure, phenology, reproductive evidence), and a map, but the newer form is less complex. West Virginia uses two different field forms. Both collect information on location, population size and structure, habitat features, and include an area for a map. One form asks more questions about population structure and rates four aspects of the element occurrence – quality, condition, viability, and defensibility.

In New Hampshire and Vermont, Plant Conservation Volunteers, as well as state botanists, may survey plants. Plant Conservation Volunteers are trained to identify plants and are then assigned certain occurrences to survey. They may also send in information about new populations that they discover. New England Plant Conservation Program monitoring groups use state Heritage reporting forms and collect GPS data points for each population. New Hampshire occurrences within the Appalachian Trail corridor were surveyed by members of New Hampshire Natural Heritage Bureau. Maine relies on state botanists, as does New York, but both will accept occurrence data from what Maine terms "rogue botanists." Reporting forms are available on-line. Ideally, each field report would contain comprehensive data, but detailed observations are frequently lacking. Thoroughly surveying a population is time-consuming and may not be feasible for large populations. Sometimes a botanist does not realize that a species is of particular interest, and so it is only noted in passing. *Agrostis mertensii* is too common in New Hampshire to be the target of surveys.

### **Research Priorities**

The species should be searched for at Killington, Pico, Stratton Mountain, Mt. Horrid, and in ski areas and Lincoln Peak, all of which have the potential for dry/mesic heath meadows at high elevations (or similar habitat components) as well as subalpine rocky environments, and so have potential for habitat (SVE Panel 2002).

Information is also needed on the disturbance dynamics associated with the dry/mesic alpine heath meadow, and particularly on lower elevation peaks because the recreation impacts may be more severe on these areas (SVE Panel 2002).

It would also be useful to know how successful *Agrostis mertensii* is at seed production, germination, and seedling survival. There are no data on how long a clump can live, how much trampling it can withstand, or what area one plant can colonize. Small population sizes on the Green Mountain National Forest are of concern, and it may be that plants here were the last remnants of a previously larger population. If that is the case, it would be good to know what factors led to the decline of the population and why new plants failed to become established.

## **REFERENCES**

Adirondack Park Agency. 2004. Available at:

[http://www.apa.state.ny.us/About\\_Park/more\\_park.html](http://www.apa.state.ny.us/About_Park/more_park.html) (Accessed May 5, 2004).

Bliss, L. C. 1963. Alpine plant communities of the Presidential Range, New Hampshire. *Ecology* 44: 678-697.

Bliss, L. C. 1966. Plant productivity in alpine microenvironments on Mt. Washington, New Hampshire. *Ecological Monographs* 36: 125-155.

Brumback W. E., L. J. Mehrhoff, R. W. Enser, S. C. Gawler, R. G. Popp, P. Somers, D. D. Sperduto, W. D. Countryman, and C. B. Hellquist. 1996. Flora Conservanda: New England. The New England Plant Conservation Program list of plants in need of conservation. *Rhodora* 98: 233-361.

Edinger, G. J., D. J. Evans, S. Gebauer, T. G. Howard, D. M. Hunt, and A. M. Olivero (editors). 2002. *Ecological Communities of New York State*. Second Edition. A revised and expanded edition of Carol Reschke's *Ecological Communities of New York State*. (Draft for review). New York Natural Heritage Program, New York State Department of Environmental Conservation, Albany, New York. Found online at: [http://www.dec.state.ny.us/website/dfwmr/heritage/Draft\\_ECNY2002.htm](http://www.dec.state.ny.us/website/dfwmr/heritage/Draft_ECNY2002.htm)

Fernald, M. L. 1933. Recent discoveries in the Newfoundland flora (continued). *Rhodora* 35: 203-223.

Gawler, S. C. 2001. Natural landscapes of Maine: a classification of vegetated natural communities and ecosystems. Maine Natural Areas Program, Department of Conservation, Augusta, Maine.

Gleason, H. A. and A. Cronquist. 1991. *Manual of vascular plants of northeastern United States and adjacent Canada*, 2<sup>nd</sup> edition. The New York Botanical Garden, Bronx, New York.

Hitchcock, A. S. 1950. *Manual of the grasses of the United States*, second edition, revised by Agnes Chase. USDA Miscellaneous Publication No. 200, Washington, DC.

Ketchledge, E. H. and R. E. Leonard. 1984. A 24-year comparison of the vegetation of an Adirondack mountain summit. *Rhodora* 86: 439-444.

Ketchledge, E. H., R. E. Leonard, N. A. Richards, P. F. Craul, and A. R. Eschner. 1985. Rehabilitation of alpine vegetation in the Adirondack Mountains of New York State. USDA Forest Service, Northeastern Forest Experiment Station, Research Paper NE-553.

Kurchenko, E. I. 1991. Ontogeny and age composition of *Agrostis borealis* Hartm. cenopopulation under conditions of unrestricted development (Russian). *Byulleten' Moskovskogo Obshchestva Ispytatelei Prirordy Otdel Biologicheskii* 96 :121-129. Abstract only.

Maine Bureau of Parks and Land. 2004. Available at <http://www.state.me.us/doc/parks/programs/prl.html> (Accessed May 5, 2004).

Maine Natural Areas Program (MNAP). 2001. Element Occurrence Summary. Maine Department of Conservation, Augusta, Maine, USA.

MOBOT, Missouri Botanical Garden web site. 2001. Available at: <http://mobot.mobot.org/W3T/Search/vast.html>

NatureServe: An online encyclopedia of life [web application]. 2001. Version 1.5. Arlington, Virginia. The Association for Biodiversity Information. Available: <http://www.natureserve.org/>

New Hampshire Natural Heritage Inventory (NHNHI). 2001. Element occurrence summaries. DRED-Division of Forests and Lands, Concord, New Hampshire, USA.

New York Natural Heritage Program. 2004. New York State Department of Environmental Conservation. Albany, New York, USA.

Pease, A. S. 1964. A flora of northern New Hampshire. New England Botanical Club, Inc., Boston, Massachusetts, USA.

Slack, N. G. and A. W. Bell. 1995. Field guide to the New England alpine summits. Appalachian Mountain Club Books, Boston, Massachusetts, USA.

Sperduto, D. 1993. Alpine/subalpine tundra formation of New Hampshire, DRAFT 3/24/93. New Hampshire Natural Heritage Inventory.

Sperduto, D. D. and C. V. Cogbill. 1999. Alpine and subalpine vegetation of the White Mountains, New Hampshire. New Hampshire Natural Heritage Inventory, Concord, New Hampshire. Submitted to the USDA Forest Service, White Mountain National Forest, Laconia, New Hampshire.

St. Hilaire, L. 2001. Literature review of *Agrostis mertensii*. Prepared for the White and Green Mountain National Forests, Laconia, New Hampshire and Rutland, Vermont, USA.

SVE Panel. 2002. Green Mountain National Forest/White Mountain National Forest species viability evaluation expert panel notes on alpine plants. Panel held: May 13-15, 2002, Rutland, Vermont.

Tateoka, T. 1975. A contribution to the taxonomy of the *Agrostis mertensii-flaccida* complex (Poaceae) in Japan. Bot. Mag. Tokyo 88: 65-87.

Thompson, E. H. and E. R. Sorenson. 2000. Wetland, Woodland, Wildland: A guide to the natural communities of Vermont. Published by The Nature Conservancy and the Vermont Department of Fish and Game. Distributed by University Press of New England, Hanover and London.

Vermont Department of Forests, Parks & Recreation. 2004. Available at: <http://www.state.vt.us/anr/fpr/> (Accessed May 5, 2004).

Vermont Nongame and Natural Heritage Program (VNNHP). 2001. Element Occurrence Summary. Department of Fish and Wildlife, Waterbury, Vermont, USA.

West Virginia Natural Heritage Program. 2004. Elkins, West Virginia, USA.

Young, S. M., editor. New York rare plant status list. New York Natural Heritage Program, New York State Department of Environmental Conservation, Latham, New York.

Zika, P. F. 1993. Historical species loss in the alpine zone of Camels Hump, Vermont. Bulletin of the Torrey Botanical Club 120 :73-75.

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## **Appendix I:**

### **An Explanation of Conservation Ranks Used by The Nature Conservancy and Natureserve**

The conservation rank of an element known or assumed to exist within a jurisdiction is designated by a whole number from 1 to 5, preceded by a G (Global), N (National), or S (Subnational) as appropriate. The numbers have the following meaning:

- 1 = critically imperiled
- 2 = imperiled
- 3 = vulnerable to extirpation or extinction
- 4 = apparently secure
- 5 = demonstrably widespread, abundant, and secure.

G1, for example, indicates critical imperilment on a range-wide basis — that is, a great risk of extinction. S1 indicates critical imperilment within a particular state, province, or other subnational jurisdiction — i.e., a great risk of extirpation of the element from that subnation, regardless of its status elsewhere. Species known in an area only from historical records are ranked as either H (possibly extirpated/possibly extinct) or X (presumed extirpated/presumed extinct). Certain other codes, rank variants, and qualifiers are also allowed in order to add information about the element or indicate uncertainty.

Elements that are imperiled or vulnerable everywhere they occur will have a global rank of G1, G2, or G3 and equally high or higher national and subnational ranks (the lower the number, the "higher" the rank, and therefore the conservation priority). On the other hand, it is possible for an element to be rarer or more vulnerable in a given nation or subnation than it is range-wide. In that case, it might be ranked N1, N2, or N3, or S1, S2, or S3 even though its global rank is G4 or G5. The three levels of the ranking system give a more complete picture of the conservation status of a species or community than either a range-wide or local rank by itself. They also make it easier to set appropriate conservation priorities in different places and at different geographic levels. In an effort to balance global and local conservation concerns, global as well as national and subnational (provincial or state) ranks are used to select the elements that should receive priority for research and conservation in a jurisdiction.

Use of standard ranking criteria and definitions makes Natural Heritage ranks comparable across element groups; thus, G1 has the same basic meaning whether applied to a salamander, a moss, or a forest community. Standardization also makes ranks comparable across jurisdictions, which in turn allows scientists to use the national and subnational ranks assigned by local data centers to determine and refine or reaffirm global ranks.

Ranking is a qualitative process: it takes into account several factors, including total number, range, and condition of element occurrences, population size, range extent and area of occupancy, short- and long-term trends in the foregoing factors, threats, environmental specificity, and fragility. These factors function as guidelines rather than arithmetic rules, and the relative weight given to the factors may differ among taxa. In

some states, the taxon may receive a rank of SR (where the element is reported but has not yet been reviewed locally) or SRF (where a false, erroneous report exists and persists in the literature). A rank of S? denotes an uncertain or inexact numeric rank for the taxon at the state level.

Within states, individual occurrences of a taxon are sometimes assigned element occurrence ranks. Element occurrence (EO) ranks, which are an average of four separate evaluations of quality (size and productivity), condition, viability, and defensibility, are included in site descriptions to provide a general indication of site quality. Ranks range from: A (excellent) to D (poor); a rank of E is provided for element occurrences that are extant, but for which information is inadequate to provide a qualitative score. An EO rank of H is provided for sites for which no observations have been made for more than 20 years. An X rank is utilized for sites that are known to be extirpated. Not all EO's have received such ranks in all states, and ranks are not necessarily consistent among states as yet.