Conservation Assessment

for the

Grove Bluegrass

(Poa alsodes A.Gray)

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ILLINOIS
NATURAL
HISTORY
SURVEY

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Poa alsodes A.Gray, from University of Wisconsin – Stevens Point website, Robert J. Freckmann Herbarium, Plants of Wisconsin. Spikelets immature. Photographer: Emmet J. Judziewicz.

http://wisplants.uwsp.edu/scripts/detail.asp?SpCode=POAALS

This Conservation Assessment was prepared to compile the published and unpublished information on the subject taxon or community; or this document was prepared by another organization and provides information to serve as a Conservation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

This Conservation Assessment is a review of the taxonomy, distribution, habitat, ecology, and status of the Grove Bluegrass, *Poa alsodes* A.Gray, throughout the United States, and in the U.S.D.A. Forest Service lands, Eastern Region (Region 9), in particular. This document also serves to update knowledge about potential threats to, and conservation efforts regarding, the Grove Bluegrass to date. *Poa alsodes* is a perennial tufted grass normally 30-60 cm tall (though it can be taller), without rhizomes, and it has been confused with several similar species (e.g., *Poa autumnalis*, *P. pratensis*, *P. sylvestris* and *P. wolfii*) but it differs from those by means of the hairless marginal nerves on its lemmas as well as by its short anthers (0.4-0.8 mm long). This generally upland grass grows mainly in shade in cool mesic hardwood forests and it appears to prefer areas of moderate to high rainfall in the northeastern United States and adjacent Canada. It is normally found growing in buffered soils that are circumneutral to slightly acidic. In the United States it has been reported from 22 states from Maine west to Minnesota and south to Kentucky, Tennessee and South Carolina. In Canada, *Poa alsodes* has been reported in five eastern provinces. There are no verified records of this grass in adjacent Iowa or Missouri. The global ranking for *Poa alsodes* is G4 (Apparently Secure) and in the United States the species is given the National Heritage status rank of N4N5 (Apparently Secure to Secure). The state rankings vary, but it has been designated as Endangered in Illinois, Rare in Indiana, and it has been included on the list of rare, threatened and endangered plants of Maryland without official state designation. It has been designated as 'At Risk' in the Shawnee National Forest of Illinois only. It is more common and not threatened in several other Region 9 and Region 8 national forests. There remains some question as to whether or not this grass actually occurs in Illinois.

In addition to species listed as endangered or threatened under the Endangered Species Act (ESA), or species of Concern by U.S. Fish and Wildlife Service, the Forest Service lists species that are Sensitive within each region (RFSS). The National Forest Management Act and U.S. Forest Service policy require that National Forest System land be managed to maintain viable populations of all native plant and animal species. A viable population is one that has the estimated numbers and distribution of reproductive individuals to ensure the continued existence of the entity throughout its range within a given planning area.

The objectives of this document are to:

-Provide an overview of the current scientific knowledge on the species.

-Provide a summary of the distribution and status on the species range-wide and within the Eastern Region of the Forest Service, in particular.

-Provide the available background information needed to prepare a subsequent Conservation Approach.

NOMENCLATURE AND TAXONOMY

Scientific Name: *Poa alsodes* A.Gray [1856]

Common Names: Grove Bluegrass; Grove Blue Grass; Grove Meadow Grass; Woodland Bluegrass; Drooping Bluegrass.
Synonymy: none known

Class: Liliopsida (Flowering Plants - Monocotyledons)
Family: Poaceae (= Gramineae; The Grass Family)
Plants Code: POAL3 (USDA NRCS plant database, W-1)
http://plants.usda.gov/

The grass genus *Poa* contains about 75 species in North America north of Mexico, 61 of which are native, five are hybrid species, and nine species are introduced (exotics), according to Soreng (2007). The genus is of rather large size within the flowering plants with about 500 species worldwide. Most species occur in cold, alpine, and temperate zones of the Northern Hemisphere, but several have been introduced around the world. *Poa* is a grass genus well known since antiquity, and, in fact, the name *poa* means *grass* or *pasture grass* in Greek, the other Greek name for grasses (spike- or tail-like grasses) being *chloa* (Fernald 1950). It is a difficult grass taxonomically because most species are polyploid (with major chromosome duplications), many are apomictic (with smaller chromosome anomalies), and hybrids are also common. Some members of the genus *Poa* also have great economic importance, because they are important native and cultivated forage and pasture grasses, and include such familiar grasses as the bluegrasses. *Poa* is also especially popular as a lawn and landscape grass, and several species are also planted for soil stabilization. *Poa* is the type genus of the entire grass family, the Poaceae. The genus is placed within the grass subfamily Pooideae tribe Poeae. Many reference books and introductory botany books use a diagram of the spikelets of this grass to represent a typical condition in the grasses.

The Grove Bluegrass, first described from New Hampshire material, was named *Poa alsodes* by the great American botanist Asa Gray [1856] using the epithet *alsodes*, Greek for *of the woodlands* or *woodsy* (interestingly, the Latin equivalent for this is *sylvatica*, but there was already a grass named *Poa sylvatica*, also named by Gray). This species has been recognized as distinct since it was described and so, unlike many other species within the group, it does not have an extensive history of synonymy. No subspecies or varieties are currently accepted, but the somewhat similar grass now known as *Poa wolfii* Scribn. was first described as *Poa alsodes* var. *wolfii* (Scribn.) Vasey ex Scribn. [in 1894].

The Grove Bluegrass has been placed within *Poa* sect. *Sylvestres* V.L. Marsh ex Soreng along with six other similar species, the eastern species *Poa autumnalis* Muhl. ex Elliott, *Poa*

saltuensis Fernald & Wiegand (including subsp. *languida* (Hitchc) A.Haines), *Poa sylvestris* A.Gray, and *Poa wolfii* Scribn., and the two west coast species *Poa kelloggii* Vasey and *Poa marcida* Hitchc. These seven species characteristically are non-rhizomatous and non-stoloniferous, their leaf sheaths are usually fused closed from 1/3 to nearly their full length, the leaf tips are narrowly prow-shaped (like the prow of a boat), the lower rachis internodes of the panicles are usually longer than 3 cm and the panicle nodes can have 1-10 ascending to spreading to eventually reflexed branches radiating from them. The spikelets can vary from 2.5 – 8.2 mm long and they are laterally compressed, the glumes are distinctly roughened and sharply keeled, and most of the species have long cobwebby kinky hairs attached to a callus within the spikelet below the lemmas. All seven species are found only in North America, north of Mexico (Soreng 2007).

Most species of *Poa* are simply called 'bluegrass' because of the impression that they have a somewhat blue-green (glaucous) color either close-up or from a distance, but this is certainly not true of all of the species. It is only in recent years that there has been an attempt to standardize the common names of the lesser-known species. The name Grove Bluegrass has been generally used for this species to distinguish it from *Poa sylvestris*, normally called the Woodland Bluegrass, despite the equivalent meanings of their two translated names.

DESCRIPTION OF THE SPECIES

Poa alsodes, the Grove Bluegrass, is a perennial non-rhizomatous, non-stoloniferous, loosely tufted grass. The several erect or suberect **stems** (culms) are usually 30-60 (-126) cm tall and 2-3 mm thick. The **foliage** is glabrous and it is concentrated at the base of the plant, continuing up the reproductive stems; the **leaf sheaths** are closed for 0.5 – 0.9 X their length; the **ligules** are 0.1 – 1.7 (-2.1) mm long, smooth or sparsely scabrous, and truncate to obtuse. The **leaf blades** are (0.8 –) 2- 4 (-5) mm wide, flat, thin, and lax. **Panicles** are (10-) 11-20 (-36) cm long, erect or lax, narrowly pyramidal, usually very open but infrequently contracted; the nodes of the panicle have whorls of (2) 3-5 (-7) **branches** attached; the branches are spreading, straight, angled, and the angles are sparsely to moderately scabrous. Some branches remain partly enclosed in the uppermost leaf sheath, but most are fully exposed and expanded, spreading, straight, and angled and the angles are sparsely to moderately scabrous (roughened). The panicle branches are generally few-flowered, and the flowers are concentrated towards the branch tips with the remainder bare to the main panicle axis. The **spikelets** are 3.5-6.7 mm long and laterally compressed. There are 2-4 **florets** per spikelet and the rachilla internodes are glabrous. The **glumes** are ovate, distinctly keeled and the keels are scabrous. The lower glumes are 1-veined and the upper glumes are shorter than or subequal to the lowest lemmas; **calluses** are conspicuously webbed, and the **lemmas** are 2.7-4.2 (-5) mm long, lanceolate, also distinctly keeled, and the keels are short-villous to about the middle and the marginal and lateral veins are glabrous. The lateral veins are faint or moderately prominent, and the intercostal regions are glabrous and smooth; the tips are acute; the **paleas** are glabrous or ciliolate over the keels,

and the tips are finely scabrous. The **anthers** are 0.4 – 0.8 mm long. The chromosome number is unknown. (Adapted from Soreng 2007 and Hitchcock and Chase 1951). A detailed illustration of this species can be found in Soreng (2007) p. 511 and an image of the species has been provided on the cover page of this assessment.

*Poa alsode*s is similar to, and has been confused with, *Poa wolfii* (formerly considered to be a variety of this species) and it has also been confused with *Poa sylvestris* and *Poa autumnalis*. The Grove bluegrass can be rather easily separated from those three species by means of its glabrous lemmas – *i.e*., the marginal nerves are hairless, though the lower half of the keel alone can have short hairs. Hairs are very evident on the marginal veins of the lemmas in *Poa autumnalis, Poa sylvestris*, and *Poa wolfii*, as well as on the very common introduced *Poa pratensis*. The short anthers (0.4-0.8 mm long) make it rather easy to separate the Grove bluegrass from *Poa sylvestris* and *Poa autumnalis* as well as from *Poa pratensis*, all of which have anthers measuring 1-2 mm long or more. *Poa wolfii* falls in the middle, with anthers 0.5 – 1.5 mm long. The spikelets of *Poa sylvestris* are generally conspicuously smaller than those of *Poa alsodes*, as well as being more hairy, and the panicle of *P. sylvestris* is both longer and narrower than that of *P. alsodes*, with shorter branches that tend to point downward, unlike those of *P. alsodes*. The lack of rhizomes or stolons also readily separates *Poa alsodes* from the common Kentucky Bluegrass, *Poa pratensis*. A detailed study of hair patterns along with diagrams and an interpretation of their development on the lemmas of most of these species was presented by Kellogg (1990).

While the Grove Bluegrass has only rarely been confused with other species of the genus taxonomically, it has been misidentified and confused in the field with the other species. Certainly, identifications on specimens can be inaccurate, but its characters do not appear to significantly or frequently overlap with those of other species, and hybrids with other species are apparently not known despite its greatly overlapping range with them (Soreng 2007).

HABITAT AND ECOLOGY

A review of the literature demonstrates that this grass is rather consistent in its habitat preferences throughout its range. *Poa alsodes* grows mainly in shade in cool mesic hardwood forests (Fernald 1950 [rich woods and thickets], Soreng 2007 [mesic woodlands], Gleason and Cronquist 1991 [moist woods], Herkert and Ebinger 2002 [mesic forests, wooded bluffs, in ravines, and in rugged wooded areas in the southern part of the state], Hitchcock and Chase 1951 [rich or moist woods]), it appears to prefer areas of moderate to high rainfall (or low evaporation rates) and it is also heat sensitive, based on its known range. Towards the north the diversity of habitats for this grass increase and they decrease towards the south, typical of species that prefer cool-climates.

The Grove Bluegrass, *Poa alsodes*, has been given the national wetland indicator status of

UPL (Obligate Upland) and FACW- (somewhat less than Facultative Wetland) indicating that the species occurs almost always in non-wetlands in some regions, but in others it usually occurs in wetlands (somewhat less than 67% - 99% of the time). In Wetland Region 3, including both Illinois and Indiana, *Poa alsodes* has been specifically designated as a FACW- species (Reed 1988; W-1; W-2), one that generally occurs in wetlands about half the time or less. In the southeastern portion of its range, in North Carolina, South Carolina and Tennessee, this grass has been classified as an Obligate Upland species and it does not occur in wetlands there.

In the northern portion of its range especially, the Grove Bluegrass has been found in a diversity of topographic sites, from the margins of lake swamps and in wet meadows and seeps along streams, to moist forests on higher slopes in upland forests, and in deep cool forested gorges, as well as on bluffs and steep hillsides among rock outcrops – but always in shade in rich, mesic forests. The substrate is not always referenced on herbarium labels or in the literature, but it has certainly been recorded to be associated with sandstone, with gravelly glacial till, and even with alkaline seeps in the north. It is not known to be associated with limestone, but it probably is not very pH specific, instead growing in buffered soils that are circumneutral to slightly acidic.

In Wisconsin, where this grass is common, its associates are well known and varied. It can be found in northern associations of *Abies balsamea – Picea – Tsuga canadensis* - and *Acer rubrum*, and it can be equally common in *Acer saccharum-Tilia americana – Ostrya virginiana* associations, and it has even been recorded in *Quercus macrocarpa* habitats (though less commonly). The later association has been called the *Quercus ellipsoidalis – Quercus macrocarpa – Pinus banksiana* Rocky Woodland (W-3). It often grows in thickets of *Alnus rugosa* and *Lonicera canadensis* along streams. Herbarium label data indicate that this grass grows in especially large or robust clumps in seeps or seepage bogs at the bases of slopes. Based upon herbarium specimen records, in Wisconsin *Poa alsodes* is commonly found in various mesic forest habitats with the **trees** *Acer rubrum, Acer saccharum, Acer spicatum, Betula alleghaniensis, Betula papyrifera, Fagus grandifolia, Fraxinus nigra, Ostrya virginiana, Pinus banksiana, Pinus resinosa, Pinus strobus, Populus* spp., *Prunus serotina, Quercus alba, Quercus ellipsoidalis, Quercus macrocarpa, Quercus rubra, Tilia americana, Tsuga canadensis, Ulmus americana,* and *Ulmus rubra,* along with the **shrubs** *Alnus rugosa, Amelanchier* spp., *Aralia nudicaulis, Corylus cornuta, Dirca palustris, Lonicera canadensis, Vaccinium angustifolium,* and *Viburnum rafinesquianum*, the **forbs** *Aster macrophyllus, Claytonia caroliniana, Conopholis americana, Dentaria diphylla, Dicentra canadensis, Laportea canadensis, Maianthemum canadense, Polygonatum pubescens, Thalictrum dasycarpum, Trientalis borealis*, and *Uvularia sessilifolia,* the **graminoids** *Brachyelytrum erectum, Carex arctata, Carex convoluta, Carex deweyana, Carex laxiflora, Carex plantaginea, Danthonia spicata, Elymus trachycaulus, Oryzopsis asperifolia, Poa compressa*, and *Schizachne purpurascens*, and the **pteridophytes** *Adiantum pedatum, Athyrium angustum, Lycopodium lucidulum,* and *Pteridium aquilinum*.

In Virginia, the typical habitat of *Poa alsodes* is within the Central Appalachian Northern Hardwood Forest community (W-4). This forest community extends from Virginia north to southern New York, and has an overlap of species between the more northern forests, and the next one (below) in the southern Appalachians. Typical **trees** present include *Acer pensylvanicum, Acer rubrum, Acer saccharum, Acer spicatum, Betula alleghaniensis, Betula lenta, Fagus grandifolia, Prunus serotina, Quercus rubra,* and *Tsuga canadensis*; an occasional **shrub** is *Ilex montana,* common associated **forbs** are *Aster acuminatus, Streptopus lanceolatus,* and *Viola blanda,* **graminoids** often include *Brachyelytrum erectum, Carex appalachica, Carex debilis, Carex digitalis, Carex leptonervia, Carex woodii, Milium effusum,* and *Schizachne purpurascens,* and typical associated **pteridophytes** include *Dennstaedtia punctilobula, Dryopteris intermedia, Lycopodium annotinum,* and *Lycopodium dendroideum*.

In the mountains of North Carolina and Tennessee, *Poa alsodes* is often found in a mesic upland forest type sometimes called a Beech Gap forest, or a *Fagus grandifolia – Carex pensylvanica – Carex brunnescens* Forest (W-3). These are usually found at elevations greater than 1370 m (4,500 ft) in the southern Blue Ridge on slopes. The **trees** growing in this association with *Poa alsodes* usually include *Aesculus flava, Betula alleghaniensis, Fagus grandifolia,* and *Halesia monticola*, the **shrubs** include *Hydrangea arborescens* and *Rhododendron* spp., **forbs** include *Ageratina altissima, Anemone quinquefolia, Angelica triquinata, Arisaema triphyllum, Aster chlorolepis, Epifagus virginiana, Erythronium umbilicatum, Impatiens pallida, Laportea canadensis, Medeola virginiana, Oxalis montana, Phacelia bipinnatifida, Phacelia fimbriata, Prenanthes altissima, Solidago glomerata,* and *Trillium erectum*, **graminoids** can include Carex aestivalis, *Carex brunnescens, Carex debilis, Carex intumescens, Carex pensylvanica,* and *Luzula acuminata,* and **pteridophytes** often include *Athyrium filix-femina, Dryopteris campyloptera,* and *Thelypteris noveboracensis*.

There is little information available on the habitat and ecology of the Grove Bluegrass in the lower Midwest, including Indiana and Illinois. For Illinois, there is almost no certain information and no herbarium material was found. This will be expanded upon in the next section. There is some information available for Indiana for the populations that occur in the northern part of that state (Swink and Wilhelm 1994). Here, as often elsewhere within its range, *Poa alsodes* usually occurs in mesic upland forests, more specifically, in Beech Forests (*Fagus grandifolia*), and in Indiana it is known mostly in the northeast part of the state. The commonly associated **trees** include *Carpinus caroliniana, Fagus grandifolia, Hamamelis virginiana, Liriodendron tulipifera, Ostrya virginiana, Quercus alba, Quercus rubra, Sassafras albidum,* and *Tilia americana*. **Shrubs** found in this plant community include the trailing *Euonymus obovatus* and *Lindera benzoin*, and a common **vine** is *Amphicarpaea bracteata*. **Forbs** are diverse, and these often include *Arisaema triphyllum, Caulophyllum thalictroides, Galium pilosum, Geranium maculatum, Hepatica americana, Mitella diphylla, Panax trifolius, Podophyllum peltatum, Prenanthes alba, Sanicula gregaria, Smilax ecirrhata,* and *Trillium*

flexipes. **Graminoids** often include *Milium effusum*, and a common **pteridophyte** found with the *Poa* is *Botrychium virginianum*.

Mohlenbrock (1959) presented a list of plants characteristic of the mesic ravines in Jackson County, Illinois, and included *Poa alsodes* among them. No voucher of this grass has been found from this habitat, but it is worth describing the habitat here based on Mohlenbrock's information. The habitat is described as rocky ravines and gorges, very mesic and often shaded and with dripping water on the steep cliffs of the vertical sandstone walls. Associated **trees** in this habitat include *Acer barbatum, Acer saccharum, Aesculus pavia, Celtis occidentalis, Fagus grandifolia, Liriodendron tulipifera*, and *Magnolia acuminata*, along with the **shrubs** *Euonymus obovatus, Lindera benzoin, Rhus typhina, Staphylea trifolia*, and *Viburnum lentago*. As in the case of the other habitats where this grass has been found, there are essentially no vines. **Forbs** are very diverse and include *Allium tricoccum, Aplectrum hyemale, Aralia racemosa, Arisaema triphyllum, Aristolochia serpentaria, Asclepias exaltata, Campanula americana, Collinsia verna, Cypripedium pubescens, Delphinium tricorne, Dodecatheon frenchii, Epifagus virginiana, Erigenia bulbosa, Erythronium albidum, Erythronium americanum, Goodyera pubescens, Hepatica acutiloba, Heuchera parviflora, Isopyrum biternatum, Mitella diphylla, Mitchella repens, Monotropa uniflora, Obolaria virginica, Orchis spectabilis, Panax quinquefolius, Phacelia purshii, Saxifraga forbesii, Scutellaria nervosa, Solidago latifolia, Spigelia marilandica, Stylophorum diphyllum, Synandra hispidula, Trillium flexipes, Trillium recurvatum, Trillium sessile, Triphora trianthophora, Uvularia grandiflora, Uvularia sessilifolia, Valeriana pauciflora*, and *Viola cucullata*. **Graminoids** include, along with *Poa alsodes, Carex careyana, Carex sparganioides, Diarrhena americana, Leersia virginica*, and *Poa sylvestris*, and the **pteridophytes** include *Adiantum pedatum, Athyrium pycnocarpon, Athyrium thelypteroides, Camptosorus rhizophyllus, Ophioglossum vulgatum, Thelypteris hexagonoptera*, and *Woodsia obtusa*. Many of these associates are found with this grass in Indiana and elsewhere, so while no Illinois vouchers of the grass were found during the course of compiling this report, the habitat does sound reasonable for the Grove Bluegrass.

DISTRIBUTION AND ABUNDANCE

Poa alsodes, the Grove Bluegrass, is found in the northeastern United States and adjacent Canada. It lives generally from Nova Scotia, Quebec and Ontario, Canada, south to South Carolina and Tennessee (Gleason and Cronquist 1991, Soreng 2007). The Grove Bluegrass has been reported from 22 states, namely, Connecticut, Delaware, Illinois, Indiana, Kentucky, Maine, Maryland, Massachusetts, Michigan, Minnesota, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, Vermont, Virginia, West Virginia, and Wisconsin (W-1, W-3; Soreng 2007, Hitchcock & Chase 1951). In Canada, *Poa alsodes* has been reported in the provinces of New Brunswick, Nova Scotia, Ontario, Prince Edward Island, and Quebec. In the United States, previous records attributing the species to Missouri were based upon misidentified specimens of *Poa wolfii* Scribn. (Yatskievych

1999). Soreng (2007), Hitchcock and Chase (1951), and Wofford (1989) did not show it to be present in South Carolina but Kartesz and Meacham (1999) and the federal agencies that use that compilation as their basis do include *Poa alsodes* in South Carolina. One specimen from South Carolina was collected in York County (Holling, pers. comm.) and the species is being tracked in South Carolina. Smith (1978) excluded it from the flora of Arkansas, and previous reports for that state were most likely based upon misidentifications. The species would appear to be out of its range there. *Poa alsodes* appears to be most frequent in Michigan, New York, Ohio, Pennsylvania, and Wisconsin; in each of those states it has been documented in 20 or more counties. It has been documented in more than 10 counties each in the states of Kentucky, North Carolina, Vermont, Virginia, and West Virginia. Its distribution suggests that this grass has two centers of frequency – the area around the Great Lakes and in the Appalachian Mountains region.

The Grove Bluegrass is thought to be at its west-central limit of distribution in southern Illinois and it has not been found to the west across the Mississippi River in Missouri or Iowa. In Illinois, where it is listed as Endangered, the species has been reported historically from widely separated sites in Calhoun, Jackson, Lake, Pope, and St. Clair counties (W-1; Mohlenbrock 1959; Mohlenbrock and Ladd 1978; Herkert and Ebinger 2002; Illinois Endangered Species Protection Board 2005; Shawnee National Forest 2005). Within the Shawnee National Forest, the Grove Bluegrass has been reported in Hayes Creek Canyon in Pope County and probably within the National Forest limits in Jackson County (Mohlenbrock 1959; Shawnee National Forest 2005) but the last reported occurrence was at the Hayes Creek location in 1986. According to Mohlenbrock (1959), *Poa alsodes* is a northeastern United States species that is characteristic of mesic rocky ravines in southern Illinois, and especially in Jackson County. While no recent records have been found, it is thought by some authorities to persist within the Shawnee National Forest as well as in Giant City State Park in Jackson County (Shawnee National Forest 2005; Herkert and Ebinger 2002). Populations of this grass are said to persist also at a national heritage landmark in Calhoun County and in a state conservation area in Lake County (Herkert and Ebinger 2002, but see comments below). The widely separated sites are located within the Morainal Section of the Northeastern Morainal Natural Division, the Driftless Section of the Middle Mississippi Border Natural Division, and the Greater and Lesser Shawnee Hills Sections of the Shawnee Hills Natural Division of Illinois (Schwegman *et al.* 1973). The population sizes are not known, and the Illinois Natural History Survey Herbarium has no specimens of *Poa alsodes* from Illinois.

Some additional comments on the occurrence of this grass in Illinois seem warranted here. As stated above, upon examining specimens of *Poa* contained within the Illinois Natural History Survey Herbarium (ILLS), specimens of this species from North Carolina and a few other states were found, but none were found from Illinois. The folders of specimens of the similar Illinois species were examined and no misidentified examples of *Poa alsodes* were found. Despite his comments in Herkert and Ebinger (2002), John Ebinger (pers. comm.) has expressed serious doubt that this grass actually occurs in the state. If it does occur in Illinois, no voucher

specimens have come to our attention. Mohlenbrock's (1959) statement that the species is characteristic of mesic ravines in southern Illinois cannot be confirmed, though the described habitat and associates are similar to those described elsewhere within its range. Swink and Wilhelm (1994) stated that the records of *Poa alsodes* from Lake County used by Herkert and Ebinger (2002) and by Mohlenbrock and Ladd (1978) were in error, because the specimens upon which those records were based were actually specimens of *Poa nemoralis*. Apparently this species was reported for Illinois in error by Moran (1978). Swink and Wilhelm did indicate that *Poa alsodes* is locally frequent in nearby Indiana, and so this grass may yet be found in northeastern Illinois where it would be well within its general range. Because it is equally likely that the grass either grows in Illinois or that it does not occur in the state, this report makes the assumption that there are verifiable vouchers of the Grove Bluegrass in Illinois somewhere, but none can currently be cited as evidence of this.

The Grove Bluegrass has been confirmed to occur in Indiana where it has been reported in nine counties, mostly in the northern counties in forests south of Lake Michigan, but also in at least one southern county (W-3; Deam 1940). It becomes more common to the north in Michigan.

This grass also occurs in neighboring Kentucky, but it has not yet been found in Missouri, though suitable habitat appears to occur there. It appears to prefer cool, moist climates and so it is restricted to northern temperate regions or to higher elevations in the more southern states.

Within the U.S. Forest Service Eastern Region (Region 9) *Poa alsodes* is reported to be present within the Shawnee National Forest in Illinois, and also within the Green Mountain National Forest in Vermont, the Monongahela National Forest in West Virginia, the Hiawatha and Ottawa National Forests in Michigan, and the Chequamegon-Nicholet National Forest in Wisconsin (W-5) but it is considered to be sensitive and at risk only in the Shawnee National Forest. The Grove Bluegrass has also been found in several national forests in the more temperate parts of the southeastern states, including (but not restricted to) the Daniel Boone National Forest in Kentucky, and the Nantahala and Pisgah National Forests in North Carolina. It is also well known to occur in Great Smoky Mountains National Park.

If the Grove Bluegrass occurs in the state, the populations in Illinois are isolated from one another, and there are no specific figures available regarding population sizes. Most herbarium labels in general do not indicate its frequency. The relatively few herbarium specimens from the Midwest and several other states appear to suggest that the Grove Bluegrass is rather sparse overall and that it may not grow in large colonies in the southern portions of its range. It is likely that the species was more common in the region at the time of European settlement because the amount of suitable forest habitat available then was greater. While it is more common towards the north, population densities are still not indicated in the literature.

Representative specimens of this grass in the United States have been listed in this report in

Appendix 1. A summary of the distribution of the Grove Bluegrass in the United States as currently known has been presented in Appendix 2.

PROTECTION STATUS

The Nature Conservancy ranking for *Poa alsodes* is G4 (G4G5 rounded to G4, Apparently Secure; W-3, W-5, Appendix 3). In the United States the species is given the National Heritage status rank of N4N5 (Apparently Secure to Secure). The state rankings vary, but it has been designated as Endangered in Illinois (Illinois Endangered Species Protection Board 2005), and Rare in Indiana. It is included on the list of rare, threatened and endangered plants of Maryland, but has no official state designation (W-6). In Canada this grass has been ranked as N4? (thought to be Apparently Secure, W-3).

Poa alsodes has been included on the Regional Forester Sensitive Species list (RFSS) for the Eastern Region, Region 9, but it is Forest Listed as 'At Risk' only in the Shawnee National Forest (W-5).

Protection for this grass is currently dependent primarily on habitat protection, and so its survival will probably depend more on this than on species protection. *Poa alsodes* is at the western-central limit of its range in Illinois and its sensitivity to warm, dry climates may be the primary reason for its scarcity in this state.

Table 1 lists the official state rank assigned by each state's Natural Heritage program according to the Nature Conservancy at their Internet site (W-3). Appendix 3 explains the meanings of the acronyms used (W-7). A summary of the current official protection status for the Grove Bluegrass follows:

U.S. Fish and Wildlife Service:	Not listed (None)
U.S. Forest Service:	Sensitive and 'At Risk' in the Shawnee National Forest only
Global Heritage Status Rank:	G4G5 – rounded to G4
U.S. National Heritage Status Rank:	N4N5
Canada National Heritage Status Rank:	N4?

Table 1: S-ranks for *Poa alsodes* [Heritage identifier: PMPOA4Z040]

State/Province	Heritage S-rank	
UNITED STATES		
Connecticut	SNR	
Delaware	S4	
Illinois	S1	[Endangered]
Indiana	S2	[Rare]
Kentucky	S4S5	
Maine	SNR	
Maryland	S2	
Massachusetts	SNR	
Michigan	SNR	
Minnesota	SNR	
New Hampshire	SNR	
New Jersey	S4	
New York	S5	
North Carolina	S4	
Ohio	SNR	
Pennsylvania	SNR	
South Carolina	SNR	
Tennessee	SNR	
Vermont	SNR	
Virginia	S3	
West Virginia	S4	
Wisconsin	SNR	
CANADA		
New Brunswick	S4	
Nova Scotia	S4	
Ontario	S4	
Prince Edward Island	S1	
Quebec	S3S4	

LIFE HISTORY

Poa alsodes is a native perennial grass that lives to an unknown age. Its rather delicate nature suggests that it may not be long lived, though it is not extremely closely related to the annual species of *Poa*. It is possible that individual plants may continue to multiply by means of continued outward (radial) growth or clump divisions for a considerable time under suitable conditions. Colonies of the species may be common locally, but this is not an aggressive or weedy species, and it has not been used as a lawn grass like some of its famous relatives. It appears to flower regularly and to successfully produce viable seeds. All flowers are bisexual and they all appear to open normally. However, little information was found on specific life history studies of this grass during the compilation of this report. The flowers are wind-pollinated as in almost all other grasses. Little is known concerning the success of establishment of new individuals from seed, nor about the genetic variability within or between colonies of this species. Putative hybrids of this with other *Poa* species are unknown (Soreng 2007) so it appears to be genetically distinct and possibly isolated or only distantly related to other *Poa* species.

The Grove Bluegrass is a member of a group of plants that utilize a very efficient photosynthetic pathway called the C3 pathway, the initial fixation product of which is 3-phosphoglyceric acid (Brown and Smith 1975). Most plants use a less efficient carbon production cycle called the C4 pathway. Grasses such as those in the genus *Poa* and many monocot and dicot weeds that utilize the C3 pathway tend to grow quickly and reproduce quickly and abundantly. This

efficiency apparently has led to the great success for its prolific relative, *Poa pratensis* (Kentucky Bluegrass), as a lawn and pasture grass. *Poa alsodes* appears to grow quickly and can become robust, but it does not spread quickly and aggressively by rhizomes as does *Poa pratensis*.

The perennial members of *Poa*, preferring cold temperate climates, grow best in cool, moist habitats and during cooler, wetter seasons of the year. Grasses of this type are referred to as cool-season grasses, and they grow poorly in southern climates. Growth in the spring is rapid from a basal tuft of leaves that usually remains green throughout the winter, and it is often dormant and buried by snow in the most northerly portions of its range in that season. One relatively large panicle of flowers is produced at the tip of each tall stem (culm) produced from the rosette, and there are normally numerous stems produced per clump. These flowers are bisexual and a great deal of pollen is produced and released into the air in the spring (causing allergic reactions in many people). Depending on the amount of moisture available and the average temperature, the plants may flower briefly or else for a longer season. A second less rapid flush of growth occurs in the autumn, generally after cool weather and rains occur, and the rosette re-establishes itself for the winter, making and storing nutrition for a rapid flowering again the following spring. No additional flowering occurs in the autumn. In order to flower successfully in the spring, this rosette must be kept free of debris such as leaf fall and snow in order to photosynthesize throughout much of the winter and earliest spring. This requirement serves to further restrict its habitat and range. *Poa alsodes* is one of many genera of northern grasses that follow this typical life history pattern. This successful reproduction pattern usually results in a thriving colony of densely clumped individuals over time in a suitable habitat.

The Grove Bluegrass does not produce rhizomes and so there is no evidence as yet that the plant can spread significantly by vegetative means. Theoretically, more plants can result from the division of the plants by vegetative reproduction, and many grasses are well known to steadily grow outward from the center point as the center dies, resulting in a ring-like colony. In the field, however, the Grove Bluegrass is usually found as separate, distinct clumps rather than as a series of small separated propagating individuals of a single clone. Instead of vegetative reproduction, it is more likely that this grass has spread very slowly throughout the southeastern states by other means, *i.e*., by gradual seed dispersal.

A study by Myers *et al.* (2004) demonstrated that the seeds of *Poa alsodes* and many other forest species are capable of being dispersed by foragers such as deer. Their experiments were able to show that this grass can germinate from seeds in deer feces after being ingested by deer. It is likely that other foragers can likewise disperse this grass in this manner, and it is known that many mammals actively seek out and consume the *Poa* species, known for their high nutritional value.

The Grove Bluegrass has been found in flower as early as 2 May in Kentucky and North

Carolina according to herbarium specimens. Herbarium records suggest that it may flower as early as early April in some areas, and that the plants can flower until late May to mid-June. Through most of its range, this grass flowers most often from about 10 May to 1 June and fruits are normally produced from about 25 May to 25 June (perhaps somewhat later, into July, in the highest mountains of the Appalachians). Essentially all (> 95 %) of the herbarium specimens examined for this report were collected in May and June.

Based upon its phenology and known distribution, this grass appears to prefer, and thrive in, cool, moist weather or climates and its range appears to be limited by drought and by moderate to extreme heat. It does not appear to grow in strictly calcareous or basic soil habitats, it is not found in full sun, and it appears to require generally moist, but not necessarily wet, soils in areas with good drainage (it avoids stagnant water areas but it will grow in seeps). Its seeds are probably dispersed by deer and other mammalian forest foragers to establish new colonies in suitable habitats.

POPULATION BIOLOGY AND VIABILITY

As suggested in the last section, *Poa alsodes* flowers regularly and with no known fertility problems throughout its range. It appears to spread primarily or exclusively by means of seeds. Outcrossing may or may not occur in this grass and studies on its fertility have not been located. Theoretically, a new colony may begin from a few seeds, perhaps even from a single plant, after being transported in a mammal's digestive system. The genetic variation of such a small initial colony would normally be quite low. In continued isolation, this can lead to some serious reproductive problems caused by inbreeding for the Grove Bluegrass.

It is generally understood that fertility is reduced in inbred populations through the process of autogamy (self-fertilization). Autogamy is useful to the plant when there are small numbers of individuals per area, since the safeguarding of the success of propagation is more important than the production of new genotypes. In primary habitats, *i.e.*, those that are generally poorly vegetated, initial success is very important. However, in subsequent periods of vegetation increase, pioneers are often substituted by other, more competitive species (W-8). In plants such as the Grove Bluegrass living at the margins of their range, self-fertilization is typical because there is usually little chance of fertilization by other individuals or genotypes. The majority of the fruits actually produced by this grass may be the result of self-pollinating flowers. The existing populations at the margins of its range in Indiana, and, perhaps, in Illinois, are very isolated from one another because of the discontinuous nature of their habitat. Continued self-fertilization in such plants can result in severe reproductive problems.

An example of negative effects thought to have arisen through isolation of populations can be seen in the case of another grass, Ofer Hollow Reedgrass (*Calamagrostis porteri* ssp. *insperata* (Swallen) C.W.Greene), which has become isolated on rather dry sandstone bluffs throughout its

range. This grass almost never produces viable seed anywhere in its range and this reproductive failure may be a reflection of a high genetic load that has occurred as a result of its long isolation (see Hill 2003). High genetic load can be seen in dominant mutations that result in factors lethal to embryos, and this situation appears to be indicated in that grass. That plant survives as a rare relict in the vegetative state only.

There is no data at this time on the fertility of any seeds produced in Illinois populations of the Grove Bluegrass because no current populations are known. If it can be clearly demonstrated to occur in the state, it would certainly remain a vulnerable species in Illinois and whether it persists or not in the state would depend on the survival and maintenance of its habitat.

The Grove Bluegrass habitat may be decreasing (see Potential Threats below). It may or may not occur at other suitable sites in Illinois and neighboring states, but it has not been reported in the state (correctly or not) since 1986 (Shawnee National Forest 2005). It is at the extreme margin of its range, if present in Illinois, and it is thought that suitable habitat for the species does appear to exist for it here, but it appears that it may have never been very common locally. At the margins of its range, viability is thought to be very poor, and the precise factors controlling its distribution at these margins are not known. There appears to be little chance of natural colonization of new habitat by this grass in Illinois because of the lack of nearby seed sources and vectors for its migration here. Therefore, the long-term viability of this locally rare grass depends entirely on the protection and management of existing populations or its introduction by means of human intervention.

POTENTIAL THREATS

Globally, the status of the Grove Bluegrass is secure and not under threat (W-3). This species is certainly vulnerable at the margins of its range where the climate is less suitable and the necessary habitats are very limited. Within Illinois, this grass has been judged to be endangered and vulnerable because, according to reports, it has a very limited state range and because there are very few, if any, populations remaining. It appears to be unable to increase its range towards the south and west within the Midwest.

Because of its already uncertain status in the state, the primary threats to this species are unknown. One can speculate, as for several other grass species, that fire suppression and canopy closure in the vicinity of its possible remnant populations along with the other extreme of clear-cutting may present problems to any remaining populations (Shawnee National Forest 2005, in part). Grazing and foraging by both domestic and wild animals, the recreational (including equestrian use) and uncontrolled experimental use of its habitat, the encroachment by exotic plant species, and the loss of habitat to development may pose significant threats to any population remaining. As stated, however, until an actual existing population of this grass is located, the idea of potential threats is moot.

It is thought that excessive shading from a lack of a normal fire regime could, hypothetically, threaten populations of this grass (Shawnee National Forest 2005). While not all grasses benefit from periodic fires, many others do, and a combination of the elimination of non-fire resistant species to open the forest as well as the addition of nutrients back to the soil may be the major benefits of a fire regime for this plant.

In contrast, because this grass prefers cool, moist forested habitats, then a fire regime and clear-cutting in its upland forest habitat may be detrimental to this and other cool-forest species, because these practices are generally known to dry out and heat the understory, especially in southern latitudes. The increased heat generated at open sites after a clear-cut can severely suppress the growth of shade loving understory species and prevents their establishment as well. Many of these understory plants, such as the Grove Bluegrass, can succumb to the sudden drying and exposure resulting from these activities and also from the associated soil disturbance and compaction from heavy machinery. Complete clearing or cutting of a forest stand could not be enacted where a colony occurs in the southern portions of its range without adverse effects to it.

Subsequent grazing by livestock after forest thinning or even without accompanying forest harvest is also likely to eliminate this grass from an area (Tilghman 1989). The pooid grasses, and especially the bluegrasses, are known to be very nutritious and they are sought out by grazing and foraging animals (Gould 1975). A sudden concentration of native foraging animals such as deer in a recently burned area at the time that this rare grass has begun to re-emerge after a fire could eliminate it from an area. In such cases, forest enclosures are recommended. In areas where deer abound, forest enclosures may be required with any type of management practice.

The development of user-created trails, in particular equestrian trails, as well as artificially cleared plots pose a likely threat to any remaining populations of this species that may occur in Illinois, especially if they occur within the Shawnee National Forest. Certainly any trampling or physical clearing of this rather delicate grass could quickly exterminate a small local population. Uncontrolled study plots should not be allowed within areas of known populations, should this be found within the forest in the future. Special restrictions would be necessary to protect the plants in such cases.

Competition from both shade and sun tolerant exotic plant species (such as the vines *Lonicera japonica* and *Rosa multiflora* and various shrubby *Lespedeza* species) may pose a threat to this rare grass in some areas, especially where the habitat has become somewhat disturbed. The Grove Bluegrass is certainly not an aggressive or competitive grass. Aggressive exotic species can form dense stands and eliminate ground layer herbaceous species including this grass not only because of excessive shading but also due to their monopolizing and removing the nutrients available in the habitat. Other offenders and threats to this native grass are exotic grasses such as

Festuca spp. and the similar *Poa pratensis*. In a newly opened habitat, the influx of these aggressive, exotic grasses could easily eliminate a less competitive native species such as *Poa alsodes*. It should also not be forgotten that native aggressive species such as various species of *Rubus* could suddenly increase in an area after prescribed burning, and these natives can also eliminate more delicate natives such as this grass. Fires do not benefit just one species. An increase in native and exotic vines, herbs, and woody plants can also threatened the hydrology of some environments by causing rapid evaporative loss of the water, and this could pose a threat to this grass as well. If such exotic species do become a factor in suppressing this rare grass, selective fire management or selective elimination of problem species may become necessary (Shawnee National Forest 2005).

The most serious threat to this somewhat delicate understory grass is from major changes or development of its habitat. The construction of roads, buildings, or parking areas, among others, can completely eliminate a small colony of rare plants. Mining as well as the construction of dams can also eliminate entire ecosystems containing this grass and many other rare plants and animals. If this grass is, indeed, a canyon species as suggested by Mohlenbrock (1959) the damming of an associated creek or river could extirpate entire relict local populations by drowning them. It is for this reason that many species are now nearly restricted to our national forests. Since European settlement, much of the previously available habitat for rare plants has been destroyed, converted to cultivated fields orchards or commercial forests, or has succumbed to land development (W-3). In more densely populated or industrialized areas, the lowering of the water table through the over utilization of water has had severe hydrological effects even on upland sites. These threats are unlikely in or near any existing populations in Shawnee National Forest.

Other threats may come from herbicide treatments along clearings in these forested areas. As in the case of clear-cutting, the increased heat generated at open sites like these can severely suppress growth and prevent understory plant establishment as well. Herbicides pose an immediate and serious threat to rare plant populations in general (W-3).

It should be stated here that while shading by woody species as forests mature is thought to present a significant threat to some understory plants such as the Grove Bluegrass, there is no data to support a complete loss of a population of this grass as a result of dense shading. Woodland *Poa* species often grow in areas locally sparsely inhabited by other vascular plants, and they seem to grow well with ferns and sedges in shade (pers. obs.). *Poa alsodes* may benefit from fire management practices, as well as the re-establishment of normal fire regimes, but more work is needed to determine a suitable and appropriate schedule for such drastic management measures.

Fragmentation and variable detrimental uses of habitat has resulted from a mix of public and private land ownership in the area where this and other rare species live, so a strong effort should

be made to add to the buffer around any verified existing colonies and their habitats. It is likely, for example, that this species is sensitive to cropland chemical runoff such as herbicides, and that agricultural fertilizer or nutrient runoff from neighboring agricultural lands will increase the success of aggressive exotic weeds in the environment. Both problems are well known to be threats to rare plants and plant communities. Care would be needed to prevent such pollutants from entering the habitat of the Grove Bluegrass. While upland forest colonies would appear to be less threatened from runoff from agricultural practices, those colonies growing primarily in cool moist floodplain forests or other low-lying habitats would be more highly threatened.

It is generally believed among biologists that habitat fragmentation can have profound effects on the success and persistence of local populations. Over time, as populations become increasingly more isolated, the effects of fragmentation can potentially be observed at the molecular level by reduced genetic frequencies caused by random drift (Barrett and Kohn 1991; see also Population Biology above). When one is considering populations that are already isolated, as in the case of any Illinois and southern populations of this wind-pollinated grass, random genetic drift may have already occurred and it may have already caused negative effects to the species.

At the current time, no verified populations of *Poa alsodes* are known in the Shawnee National Forest and so potential threats are totally speculative and management practices are moot. However, should any verified colonies be found, their extirpation could occur from the use of new user created trails, herbicide use, animal foraging activities, or certain unsupervised management practices.

RESEARCH AND MONITORING

Research is needed on the Grove Bluegrass to gain a better understanding of it and its needs. There is very little published on the details of this grass' life cycle, reproductive characteristics, viability, and management, possibly because it is not threatened in most areas where it occurs. At this time, one of the primary needs is to more precisely determine its current and historical range through the examination of herbarium specimens of this and similar species that may have been incorrectly identified. Research needs include continued and additional searches for any verifiable populations in Illinois to re-evaluate the plant's status. Fieldwork is an important and integral part of the research plan.

Research is needed on the basic life history of this grass. Specific details are not known concerning its fertility, dispersal mechanisms, germination and establishment requirements, growth rates, and genetic health (including variability). It would be useful to know how long the seeds are viable and how many must be in the seed bank to insure the survival of a colony. Also of major importance is basic experimental data on how this grass responds to fire. Because there are no verified populations of this grass in Illinois, if any are found caution is needed during field research to avoid harming the colonies. Research will then be needed on both prescribed fire and

selective thinning of the canopy in order to better and quantifiably determine the effects of increased light levels to the habitat and populations of this grass for the purpose of potentially better management (W-3, regarding similar species).

Some populations of *Poa alsodes* are being monitored currently by botanists working on behalf of the state Natural Heritage programs in a very few areas, such as in Indiana especially in the northern Indiana Dunes region. Periodic monitoring is needed not only to supply data on its life history, but also to determine the threats to its habitat including edge effects such as drying, habitat destruction, and from exotic species wherever this grass occurs. It is generally recommended for rare plants that the habitat quality where they grow should be monitored on a regular basis and an assessment of the specific threats to all populations should be made (W-3; Webb *et al.* 1975). Long-term monitoring of known populations should be conducted every 1-2 years to track their status with respect to these current management activities. Population stability, reproduction, and vigor should all be monitored. While hydrology and humidity fluctuations are assumed to occur in its habitat, it is not known precisely how much fluctuation can occur without adversely affecting the plants. It is also not known how well this grass can be established in newly created forested sites, though it is probable that it could be successfully introduced to new or to mitigation sites if necessary.

Another important consideration is the unknown effect of prolonged or continuous foraging on this grass by deer or other mammals. It is possible that it is selectively eaten – but there is no hard data to support this. An enclosure (animal exclosure) around a verified colony along with a careful inventory for several years would be a simple way to test this hypothesis (Tilghman 1989). Related to this, the incursion of horses or other livestock into its habitat can pose a serious and immediate threat to the small colonies of this grass, as experience has shown with user-created trails. It is not known exactly how much disturbance can occur before an individual population is adversely affected, nor is it known how large a suitable site must be to support a viable population. Monitoring may assist in determining the health of each population once it is known exactly what the environmental parameters should be for optimal growth.

Population data for this grass is made more difficult by the fact that it is sometimes difficult to identify or to distinguish it from related species. When sterile, this grass is not easily distinguished from related species, though some can be eliminated from consideration because of *Poa alsodes* lack of stolons and rhizomes. Local species growing with it at a given site should all be identified and distinguished before any research on the Grove Bluegrass can begin, because this grass is known to associate with other very similar *Poa* species such as *Poa pratensis*. Positively identified clumps should be carefully marked with fireproof markers that will last long enough for repeating observations over several years. A mix-up in labels with other very similar species in the same vicinity can result in useless data, and this could be an especially serious problem in studies of this grass. Once the plants are carefully identified and marked, then one can determine how many distinct plants actually occur at a given site.

Subsequently, information can be gathered on how many genetically distinct individuals may actually occur at a site, as well as on seedling establishment and success. Only careful molecular investigation can ultimately determine the number of genotypes in any given population, and this data will be useful in determining the extent of population inbreeding and the degree of genetic variability present in any Illinois populations.

If the grass is shown to be present, periodic surveys will be needed to determine the health and productivity of the population by counting the numbers of individuals. This is the only means to determine population trends accurately (W-3, for similar species). Reproductive success can be estimated by counting the number of fruiting stems or fruiting tufts produced by each plant during the season, because seedlings and young plants cannot usually be distinguished in the field. Furthermore, it is important to gather phenology data on the local flowering and fruiting period within the colony, as this can guide the seasonality of forest management procedures (one would not wish to have a prescribed burn at the peak of fruiting of this grass). Therefore, as part of the basic research on any current populations of this species, data such as the counts of numbers of individuals present (or the area covered by the colony), the determination of the amount of yearly flowering and seed production that might occur, and an assessment of recruitment rates are needed in order to monitor population dynamics and to assess the viability of the individual populations found. Individual plants should be monitored over time at each site for basic phenology data. Such basic facts as fungal associations (if any), longevity, and yearly variations in colony size over a long period are not precisely known.

Poa alsodes and many other grasses are so poorly understood and ignored by all but a few skilled botanists that a primary emphasis should be to first locate and vigorously protect all remaining local populations. It is crucial, of course, to have the identifications confirmed by a specialist in the group. Similar habitat should be explored for the plant at its flowering and fruiting seasons. There are moderate areas of suitable habitat in both northern and southern Illinois where the grass could exist. A list of associates and indicator species has been compiled as a result of field studies in other states (see Habitat section above). These indicator plants can be very useful in facilitating the discovery of populations of this grass. Fruiting or flowering material is normally needed for positive identification of this grass, but mature seeds may not be necessary. Particular attention should be made to search and / or monitor this grass at its peak period for fruiting in one's local area, normally in May to mid June. Because of the general difficulties in identifying this grass, voucher specimens should be made according to techniques described in Hill (1995) or other similar references. It is quite possible that populations of this species have been overlooked because of the difficulties in field identification as well as because of the lack of adequate voucher material with which to compare specimens.

Botanical surveys conducted by scientists from the Illinois Natural History Survey and elsewhere have shown repeatedly that with sufficient time and funding, and an experienced eye, many plants thought to be extirpated or else threatened or endangered occasionally can be found at

additional locations (Hill 2002). These sorts of investigations have been important in that they have led not only to the de-listing of species once thought to be rare, but they have also resulted in the discovery of species previously unknown in the state. The U.S. Forest Service and other related agencies have done a fine job in the effort to preserve rare species with the resources that they have available. Much of the locating and monitoring of known populations of rare species in southern Illinois has been conducted by Forest Service biologists and students in cooperation with Illinois Department of Natural Resources personnel. However, a continuing problem is that there is neither sufficient funding nor are there enough botanists available to survey the immense area that needs to be covered in the monitoring of the large numbers of sensitive plants, including this one. It appears that a high priority should be given to the training and hiring of more qualified field botanists to achieve these goals.

RESTORATION

There are no known restoration efforts being conducted specifically on *Poa alsodes* anywhere in its range and the restoration potential of this particular species is largely unknown. Observations on this and related grasses have indicated that successful fruit production in this species does occur, and that reproduction may be primarily by seed. It is also presumed that the restoration potential of this and many other grasses is good (W-3). The bluegrasses are commonly grown as lawn grasses (though not this species) and so their growth requirements are quite well known.

The generally recommended method to restore populations of this and other rare plants is to protect and manage their habitat, as discussed in the previous section as well. Opening of densely shaded habitats may be necessary for any increased success for the survival of this grass if it is eventually verified to occur in Illinois. The control of access to the known sites by hikers, equestrians, and off road vehicles appears to be equally necessary for any restoration attempt. Exotic and aggressive species should be eliminated from each restoration site. This would entail physically pulling them out because it is very likely that herbicide application would eliminate this species at a site as well. The use of controlled burns, the thinning of the overstory, and the thinning of competing understory species are suggested but as yet somewhat untested means of managing for this plant, and some caution should be given to these methods until more data has been obtained on their effects.

Restorations of any native plant species are recommended using only propagated material grown from native, local populations to avoid mixing genotypes not adapted to the local conditions and to avoid compromising the local gene pool. If this rule is not followed, the result is generally the loss of plants because the non-native forms may not be competitive under local conditions or the result could be the success of a plant or plants that cannot be considered truly native (considered by some to be a partial plant community reconstruction rather than a restoration). Local plants should be propagated for planting in such an effort. Grasses are normally easily propagated by means of fresh seeds and / or simple division (pulling apart dense stem clumps) under controlled

conditions. Currently, the nearest known populations of this grass to Illinois are in Indiana and Kentucky, and those colonies may be adequate to provide propagative material for a potential restoration, if this is deemed appropriate.

This grass and its seeds are not known to be commercially available in this country.

SUMMARY

The Grove Bluegrass, *Poa alsodes*, is a perennial tufted grass normally 30-60 cm tall (though it can be taller), without rhizomes, and it has been confused with several similar species (e.g., *Poa autumnalis*, *P. pratensis*, *P. sylvestris*, and *P. wolfii*) but it differs from those by means of the hairless marginal nerves on its lemmas as well as by its short anthers (0.4-0.8 mm long). This generally upland grass grows mainly in shade in cool mesic hardwood forests and it appears to prefer areas of moderate to high rainfall in the northeastern United States and adjacent Canada. It is normally found growing in buffered soils that are circumneutral to slightly acidic. In the United States it has been reported from 22 states from Maine west to Minnesota and south to Kentucky, Tennessee, and South Carolina. In Canada, *Poa alsodes* has been reported in five eastern provinces. There are no verified records of this grass in adjacent Iowa or Missouri. The global ranking for *Poa alsodes* is G4 (Apparently Secure) and in the United States the species is given the National Heritage status rank of N4N5 (Apparently Secure to Secure). The state rankings vary, but it has been designated as Endangered in Illinois, Rare in Indiana, and it has been included on the list of rare, threatened and endangered plants of Maryland without official state designation. It has been designated as 'At Risk' in the Shawnee National Forest of Illinois only. It is more common and not threatened in several other Region 9 and Region 8 national forests. There remains the crucial question as to whether or not this grass actually occurs in Illinois because no verified populations are currently known to exist in the state.

Research and management for extant colonies of *Poa alsodes* must include a search for verified colonies in the field and from herbarium records. Subsequently, research may include a setup of monitoring procedures and basic studies on this grass, the careful opening (reduction of shade) of its existing habitat, the prevention of clear-cut logging and most recreational uses in its vicinity, the monitoring and possible exclusion of grazing and browsing mammals in its vicinity, the experimental investigation of management techniques such as the use of prescribed fire or the selective thinning of the canopy in order to maintain suitable light levels for growth and flowering, and the elimination of exotic and aggressive native plant encroachment in the understory. Its habitats, when discovered, will need protection from land development and from indiscriminate herbicide application as well as from possible agricultural chemical runoff that may pollute them. At this time, no verified current populations are known in Illinois, and the establishment of populations will be only through active human efforts.

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APPENDIX 1

Representative United States specimens of *Poa alsodes* examined or cited in the literature

Herbaria:

ILLS = Illinois Natural History Survey, Champaign. MO = Missouri Botanical Garden, St. Louis. TAES = Tracy Herbarium, Texas A&M University, College Station. UNAF = University of North Alabama, Florence. USCH = University of South Carolina, Columbia.

CONNECTICUT: HARTFORD CO., West Street, Rocky Hill, 5 Jul 1978, *Hill 7449* (TAES); **NEW HAVEN CO**., Bethany, Bethany Bog, 20 May 1962, *Elunger 3977* (MO); **NEW LONDON CO.**, Latimer Point Road at US Rt. 1, Stonington, 20 Jul 1990, *Hill 21716* (VT).

KENTUCKY: WOLFE CO., Swift Camp Creek, 11 May 1969, *Higgins 1269* (MO).

MARYLAND: GARRETT CO., Oakland, May 1921, *Plitt s.n.* (MO).

MASSACHUSETTS: BERKSHIRE CO., Mt. Race, Mount Washington, 7 Jun 1919, *Churchill s.n.* (MO); Williamstown, Broad Brook, Sand Springs, 31 May 1898, *Churchill s.n.* (MO); **FRANKLIN CO.**, bank of Green River, Greenfield, 22 May 1929, *Churchill s.n.* (MO); **MIDDLESEX CO.**, Framingham, 24 Jun 1892, *Smith s.n.* (MO).

MICHIGAN: INGHAM CO., Michigan State University campus, East Lansing, 14 May 1980, *Gereau 396* (MO).

MINNESOTA: CARLTON CO., Silver Creek, 12 June 1891, *Sandberg 178* (MO); Thomson, June 1891, *Sandberg s.n* (MO); **CLEARWATER CO.**, Itasca Park, 23 Jun 1930, *Moyle 45* (MO).

NEW YORK: CAYUGA CO., Bear Swamp, Sempronius township, 5 Jun 1947, *Smith, Huttleston, & Rogerson 3188* (MO); **CHAUTAUQUA CO**., The Gulf, NW of Mayville, 14 May 1949, *Smith, Burch, & Terrell 5316* (MO); **CHEMUNG CO**., Laurel Hill, town of Erin, 26 May 1946, *Smith 2556* (MO); **ERIE CO.,** Buffalo, 18--, *Clinton 9478*, (MO); **GREENE CO.**, Greenville, near Basic Creek, 28 May 1989, *Tucker 4346* (MO); **LIVINGSTON CO**., along Canaseraga Creek, ca. 3 mi NW of Dansville, 16 Jun 1948, *Smith 4094* (MO); **MADISON CO.**, Lewis Point, Oneida lakes, 14 Jun 1927, *House 14227* (MO); **MONTGOMERY CO**., east of Amsterdam, 10 Jun 1948, *Smith 3890* (MO); **SENECA CO.**, near Elm Beach, Romulus, 16 May 1915, *Eames 3537* (MO); **TOMPKINS CO.**, east of Beaver Brook, Dryden, 31 May 1914, *Metcalf 1695* (MO); **ULSTER CO.**, along Esopus Gorge, near Atwood, 2 Jun 1948, *Smith, Dunbar, Dunbar, & Schulze 3816* (MO).

NORTH CAROLINA: AVERY CO., on Beech Mountain, 16 Jun 1968, *Radford 45517* (UNAF); **JACKSON CO.**, Rt. 107 S of Tuckasegee, 2 May 1991, *Hill 22207* (MO); **MITCHELL CO.**, Roan Mountain, Jul 1889, *Scribner 16467* (MO); **SWAIN CO.**, Great Smoky Mtns. National Park, 5 May 2005, *M.J.C.Murphy et al. 51.1* (ILLS).

OHIO: CUYAHOGA CO., Berea, Jun 1896, *Ashcroft s.n.*, (MO).

PENNSYLVANIA: ERIE CO., Corry, 1 Jun 1893, *Churchill s.n.* (MO); **SULLIVAN CO.**, 1865, *Smith 9497* (MO); **UNION CO**., White Eer, 4 Jun 1950, *Reed s.n.* (MO); **WESTMORELAND CO.**, along Darlington - Rector Rd, ca. 11 km SSE of US Hwy 30, Ligonier township l, 25 May 1980, *Utech 80-106* (MO).

SOUTH CAROLINA: YORK CO., Kings Mountain State Park, vicinity of Camp York, 20 May 1993, *Kennemore s.n.* (USCH).

TENNESSEE: COCKE CO., Cosby Creek Campground, Great Smoky Mtns. National Park, 30 Apr 2000, *Busemeyer et al. 43* (ILLS); **SEVIER CO.**, near Indian Gap Hotel, May 1929, *Anderson 12* (MO); W slope Clingman's Dome, Great Smoky Mtns. Nat. Park, 25 Jul 1956, *Van Schaack 3531* (MO).

VERMONT: BENNINGTON CO., Red Mountain, Arlington, 24 Jun 1964, *Seymour 21619* (MO); **LAMOILLE CO**., Waterville, 18 Jun 1966, *Seymour 23794* (MO); Smuggler's Notch, 16 Jun 1878, *Brainerd s.n.* (MO); **ORANGE CO.**, along Martin Brook, 4 Jun 1966, *Seymour 23590* (MO; **ORLEANS CO**., near Willoughby Lake, 8 Jun 1895, *Churchill s.n.* (MO).

VIRGINIA: FAIRFAX CO., Potomac River opposite Washington, D.C., 23 May 1889, *Churchill s.n.* (MO).

WEST VIRGINIA: PRESTON CO., just west of MD line, Rt. US 50, 16 Jun 1961, *Reed 50877* (MO); **RANDOLPH CO.**, Glady, 11 May 1929, *Berkley 18* (MO).

WISCONSIN: ADAMS CO., Coldwater Canyon at bridge, Dells of the Wisconsin River, 10 May 1964, *Iltis et al. 21818* (MO, WIS); **FLORENCE CO**., Lauterman Lake, Nicholet National Forest, 5 Jul 2001, *Feist & Molano-Flores 1032* (ILLS).

APPENDIX 2.

The Historic Distribution of *Poa alsodes* in the United States.
Information from herbarium specimens and the literature.
(If in > 10 counties, then only number of counties included.)

STATE	COUNTIES	NOTES
Connecticut	Every county (7 cos.) except Middlesex	W-1; Magee and Ahles (1999)
Delaware	Kent, Sussex	W-1
Illinois	Calhoun, Jackson, Lake, Pope, St. Clair	W-1, W-3, W-5; Mohlenbrock and Ladd (1978); Mohlenbrock (1986); includes Shawnee N.F.
Indiana	Allen, De Kalb, Jefferson, La Porte, Marshall, Porter, St. Joseph, Steuben, Wells	W-1, W-3; Deam (1940); Swink and Wilhelm (1994).
Kentucky	14 counties, mostly southeastern	W-1; includes Daniel Boone N.F.
Maine	Androscoggin, Aroostook, Knox, Oxford, Somerset	W-1; Magee and Ahles (1999)
Maryland	Allegany, Garrett [westernmost county], Washington	W-1, W-3; Matthew Smith (unpublished atlas of the vascular plants of MD)
Massachusetts	Berkshire, Franklin, Hampden, Hampshire	W-1; Magee and Ahles (1999)
Michigan	> 30 counties, scattered, few in NE of lower peninsula	W-1, W-5; Voss (1980). Includes Hiawatha and Ottawa N.F.
Minnesota	Benton, Carlton, Chisago, Kanabec, Lake, Morrison, Pine, St. Louis	W-1; Ownbey and Morley (1991)
New Hampshire	Coos, Carroll, Grafton, Strafford. The type specimen was collected in Plymouth, Grafton County, in 1855.	W-1; Magee and Ahles (1999)
New Jersey	Hunterdon, Morris, Sussex, Warren	W-1
New York	> 40 counties, widespread	W-1
North Carolina	11 counties, primarily mountains	W-1; Radford *et al.* (1968); Herbarium specimens; includes Nantahala N. F., Pisgah N.F., Smoky Mountains National Park

Ohio	20 counties, eastern two/thirds of state	W-1
Pennsylvania	> 30 counties, scattered, least frequent in southeastern ¼	W-1; Wherry *et al.* (1979); Rhoads and Block (2000)
South Carolina	York	W-1, W-3; Holling (pers. comm.)
Tennessee	Blount, Campbell, Carter, Cumberland, Knox, Monroe, Morgan, Sevier - [E third, higher elevations]	W-1; Chester *et al.* (1993). Includes Smoky Mountains National Park.
Vermont	Every county (14)	W-1, W-5; Magee and Ahles (1999); includes Green Mountain N.F.
Virginia	17 counties, mostly blue ridge and mountains	W-1
West Virginia	15 counties, mostly mountains	W-1, W-5; includes Monongahela N.F.
Wisconsin	>24 counties, mostly northern and eastern	W-1, W-5; includes Chequamegon-Nicholet N.F.

APPENDIX 3.

Natural Diversity Database Element Ranking System

Modified from: http://www.natureserve.org/explorer/ranking.htm [W-7]

Global Ranking (G)

G1
Critically imperiled world-wide. Less than 6 viable elements occurrences (populations for species) OR less than 1,000 individuals OR less than 809.4 hectares (ha) (2,000 acres [ac]) known on the planet.

G2
Imperiled world-wide. 6 to 20 element occurrences OR 809.4 to 4,047 ha (2,000 to 10,000 ac) known on the planet.

G3
Vulnerable world-wide. 21 to 100 element occurrences OR 3,000 to 10,000 individuals OR 4,047 to 20,235 ha (10,000 to 50,000 ac) known on the planet.

G4
Apparently secure world-wide. This rank is clearly more secure than **G3** but factors exist to cause some concern (i.e. there is some threat, or somewhat narrow habitat).

G5
Secure globally. Numerous populations exist and there is no danger overall to the security of the element.

GH
All sites are historic. The element has not been seen for at least 20 years, but suitable habitat still exists.

GNR
Not ranked globally. The element is not known sufficiently or there is some question as to its ranking at the current time.

GX
All sites are extirpated. This element is extinct in the wild.

GXC
Extinct in the wild. Exists only in cultivation.

G1Q
Classification uncertain. The element is very rare, but there is a taxonomic question associated with it.

National Heritage Ranking (N)

The rank of an element (species) can be assigned at the national level. The **N-rank** uses the same suffixes (clarifiers) as the global ranking system above. **NNR** = not ranked nationally.

Subspecies Level Ranking (T)

Subspecies receive a **T-rank** attached to the G-rank. With the subspecies, the G-rank reflects the condition of the entire species, whereas the T-rank reflects the global situation of just the subspecies or variety. **TNR** = not ranked at the taxonomic level in question. While rarely used, the rank of **TU**, tentatively undetermined, apparently indicates that the taxonomy of the entity is unknown, or questionable.

For example: *Chorizanthe robusta* var. *hartwegii*. This plant is ranked **G2T1**. The G-rank refers to the whole species range (*i.e*., *Chorizanthe robusta*, whereas the T-rank refers only to the global condition of var. *hartwegii*. Otherwise, the variations in the clarifiers that can be used match those of the G-rank.

State Ranking (S)

S1
Critically imperiled. Less than 6 element occurrences OR less than 1,000 individuals OR less than 809.4 ha (2,000 ac). **S1.1** = very threatened; **S1.2** = threatened; **S1.3** = no current threats known.

S2
Imperiled. 6 to 20 element occurrences OR 3,000 individuals OR 809.4 to 4,047 ha (2,000 to 10,000 ac). **S2.1** = very threatened; **S2.2** = threatened; **S2.3** = no current threats known.

S3
Vulnerable. 21 to 100 element occurrences OR 3,000 to 10,000 individuals OR 4,047 to 20,235 ha (10,000 to 50,000 ac). **S3.1** = very threatened; **S3.2** = threatened; **S3.3** = no current threats known.

S4
Apparently Secure. This rank is clearly lower than S3 but factors exist to cause some concern

(*i.e.*, there is some threat, or somewhat narrow habitat).

S5
Secure. Demonstrably secure to ineradicable in the state.

SH
All state sites are historic; the element has not been seen for at least 20 years, but suitable habitat still exists. Possibly extirpated.

SNR, SU, S?
Reported to occur in the state. Otherwise not ranked.

SX
All state sites are extirpated; this element is extinct in the wild. Presumed extirpated.

Notes:

1. Other considerations used when ranking a species or natural community include the pattern of distribution of the element on the landscape, fragmentation of the population/stands, and historical extent as compared to its modern range. It is important to take a bird's eye or aerial view when ranking sensitive elements rather than simply counting element occurrences.

2. Uncertainty about the rank of an element is expressed in two major ways: by expressing the rank as a range of values (*e.g.*, **S2S3** means the rank is somewhere between **S2** and **S3**), and by adding a '**?**' to the rank (*e.g.* **S2?**). This represents more certainty that the rank is **S2** than **S2S3**, but less certainty than **S2** alone.