New England Plant Conservation Program

Conservation and Research Plan

Aster concolor L.
Eastern silvery aster

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SUMMARY

Aster concolor L. (Asteraceae), Eastern silvery aster, a distinctive, late flowering, fire-adapted North American Atlantic coastal plain composite, appears to be in decline throughout its range, where habitat loss due to fire suppression, plant community succession, and development are major threats. Although this plant occurs in fourteen states and is considered widespread but uncommon in the southeast, it is either historic or vulnerable to extirpation at its northern limit in southern New England.

Aster concolor is a species of coastal plain affinity that has been recorded from the "outpost" areas off southern New England, where the climate is moderated by proximity to the Gulf Stream. There are no records on the mainland north of Rhode Island and southeastern Massachusetts, and there are no records from Cape Cod. Throughout its range *Aster concolor* occurs mostly in open pinelands, savannas, and grassy openings in pine-oak woodlands with dry, sandy soils. In New England it is now restricted to grassy openings, mostly along road edges and fence lines in successional coastal heathland, where it is a component of the high diversity native sandplain grassland association, along with 20 other regionally and globally rare plant taxa.

The immediate objectives of this plan are to locate existing occurrences of *Aster concolor;* to implement a management regime (combined prescribed burn, mow, litter-removal) that leads to demonstrable natural recruitment and increases in adult population size; and to secure all unprotected sites through land acquisition or conservation easement. Long- term goals are to reestablish populations at historic locations where habitat restoration is feasible and where continued management for disturbance-related, fire-adapted grassland species can be provided. Reintroduction, from the remaining native New England or Northeast lineages, of three or more self-sustaining colonies on Martha's Vineyard and three or more in Washington County, Rhode Island, would help to ensure the taxon's survival in the northeastern portion of its range.

Restoration of *Aster concolor* as a feature of the restored sandplain grassland/coastal heathland mosaic of Nantucket is the main goal of this plan. This goal could be accomplished through species-specific projects within the coastal heathlands habitat management program of the Nantucket Heathlands Partnership, a consortium of Town and conservation organizations formed to restore and protect this fast-disappearing habitat.

Further investigation of *Aster concolor* demographics (especially in response to disturbance), reproductive biology (especially self-incompatibility), pollinators and effects of herbivory will likely be required in order to accomplish these objectives.

PREFACE

This document is an excerpt of a New England Plant Conservation Program (NEPCoP) Conservation and Research Plan. Full plans with complete and sensitive information are made available to conservation organizations, government agencies, and individuals with responsibility for rare plant conservation. This excerpt contains general information on the species biology, ecology, and distribution of rare plant species in New England.

The New England Plant Conservation Program (NEPCoP) is a voluntary association of private organizations and government agencies in each of the six states of New England, interested in working together to protect from extirpation, and promote the recovery of the endangered flora of the region.

In 1996, NEPCoP published "*Flora Conservanda*: New England," which listed the plants in need of conservation in the region. NEPCoP regional plant Conservation Plans recommend actions that should lead to the conservation of *Flora Conservanda* species. These recommendations derive from a voluntary collaboration of planning partners, and their implementation is contingent on the commitment of federal, state, local, and private conservation organizations.

NEPCoP Conservation Plans do not necessarily represent the official position or approval of all state task forces or NEPCoP member organizations; they do, however, represent a consensus of NEPCoP's Regional Advisory Council. NEPCoP Conservation Plans are subject to modification as dictated by new findings, changes in species status, and the accomplishment of conservation actions.

Completion of the NEPCoP Conservation and Research Plans was made possible by generous funding from an anonymous source, and data were provided by state Natural Heritage Programs. NEPCoP gratefully acknowledges the permission and cooperation of many private and public landowners who granted access to their land for plant monitoring and data collection.

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I. BACKGROUND

INTRODUCTION

Aster concolor L. (Asteraceae) is a distinctive, late-flowering, fire-adapted North American Atlantic Coastal Plain species that appears to be declining throughout its range. This taxon is ranked Regionally Rare or Division 2, "with fewer than 20 current occurrences (seen since 1970) within New England" (Brumback et al. 1996). It reaches the northern edge of its range in our region. Once described as "conspicuous" on Nantucket and "a very common aster of Chappaquiddick Island" (Bicknell 1915), with additional occurrences in Washington County, RI, and Wareham, MA, *Aster concolor* is now state-ranked S1 (Endangered) in Massachusetts and is Historic in Rhode Island. It has not been recorded in the other New England states. The assigned Global Rank of "G4?" indicates that the taxon's status is uncertain; it is thought to be secure globally, but may be rare or declining especially at the periphery of its range.

A major threat to this taxon's survival is habitat loss resulting from a combination of fire suppression, plant community succession, and development. Although it occurs in fourteen states and is considered widespread but uncommon in the southeast (Bruce Sorrie, Botanical Consultant, Longleaf Ecological**,** personal communication), *Aster concolor* is now historic or vulnerable to extirpation at all sites in the northeast. At its northern limit in southern New England, *Aster concolor* occurs only in grassy heathlands on the outer coastal plain of Nantucket, Massachusetts. At least partially because of habitat limitations, plants occur in low numbers at most of the six known current sites. Fortunately, most of these extant occurrences are on public or private conservation land where plans to expand and maintain sandplain grassland and coastal heathland are being developed and implemented for both rare habitat and rare species protection. The success of these conservation efforts is extremely important to the survival of *Aster concolor* as a component of the New England flora.

Details of *Aster concolor*'s specific requirements for survival are not readily available in the literature. Such variables as microhabitat requirements (soil conditions, moisture, root competition, shading), characteristics of the taxon's reproductive ecology (self-compatibility, pollination requirements, seed production, seed viability), genetic diversity, susceptibility to hybridization, growth habit, and response to disturbance (fire, mowing, and herbivory) all need further investigation. Generally, *Aster* species are self-incompatible (Bertin and Kerwin 1998) and thus require compatible mating types for successful reproduction. Probability of maintaining sufficient numbers of mating types increases with increasing population size and with potential for gene flow from multiple populations (Barrett and Kohn 1991, Ellstrand and Elam 1993). If

Aster concolor is self-incompatible, this factor may further contribute to the scarcity of a taxon with severe habitat limitations.

DESCRIPTION

Aster concolor is a slender, herbaceous perennial forb, growing 3 dm to 10 dm in height. Simple or sparingly branched, loosely prostrate stems arise singly or in small numbers (3-20) from a thickened, rhizomatous root crown or caudex. The sericeous leaves are lanceolate or oblong to broadly elliptic to 5 x 1.5 cm, and are sessile but not clasping. Leaves often have a silky, hence silvery, appearance and are smooth to the touch. The inflorescence is narrow and racemiform, and occasionally the inflorescence has racemiform branches. Each head bears eight to 16 female ray flowers, 7-12 mm in length. *Aster concolor* is the only lilac-flowered (bluish pink) aster in our region. Its distinctive, showy lilac rays surround monoecious disk flowers that are white prior to anthesis and later darken to purple following pollination. Achenes are densely sericeous (Gleason and Cronquist 1991). Throughout its range, *Aster concolor* is a fall-blooming species. In Massachusetts it begins to emerge from the surrounding grass cover by mid-August and blooms late in the season, from September to early October (Massachusetts Natural Heritage and Endangered Species Program 1993).

TAXONOMIC RELATIONSHIPS, HISTORY AND SYNONYMY

Aster concolor, a member of the family Asteraceae, subfamily Astereae, was originally collected by Kalm in eastern Virginia, and described by Linnaeus (1753: 874). *Aster concolor*'s several synonyms include *Aster concolor* L. var. *simulans* (Small) R. W. Long, *Aster plumosus* Small, *Aster simulatus* Small, *Lasallea concolor* (L.) Semple and L. Brouillet, and *Virgulus concolor* (L.) Reveal and Keener. Recent research on the genus, *Aster* s.l., has indicated that the North American species are genetically distinct from those of Eurasia and the Southern Hemisphere (Noyes and Rieseberg 1999), supporting Nesom's 1(994) placement of the North American *Aster* in a new Basionym, *Symphyotrichum*. Xiang and Semple (1996; cited in Noyes and Rieseberg 1999) have evidence from chloroplast restriction site data that Old and New World *Aster* taxa are intimately related. Noyes and Rieseberg report that, "based on phylogenetic analysis of nucleotide sequence data from internal transcribed spacers (ITS) of nuclear ribosomal DNA," North American *Aster* s.l. is also polyphyletic.

A related but geographically separated similar congener, *Aster sericeus* Vent (western silvery aster), occurs in dry prairies and other open places to the west, from Michigan to South Dakota, south to Missouri and Texas, and irregularly to eastern Tennessee. Distinguishing features of *Aster sericeus* are a branching, corymbiform inflorescence, glabrous stems, and glabrous achenes (Gleason and Cronquist 1991: 584.). A third silver aster, *A. pratensis* Raf. = *S. pratensis* (Raf.) Nesom, the barrens silver aster, formerly considered a variety of *A. sericeus*, co-occurs with *A. sericeus* in the south (USDA Plants national database website), but its distribution does not overlap with that of *A. concolor*. Research shows on several

taxonomic levels that the silvery asters are genetically distinct from each other. Recent studies indicate a chromosome number of $2n = 8$ or 16 for *Aster concolor*, instead of numbers based on 5 as in the other 2 species" (Ronald Jones, personal communication).

Table 1. Comparison of *Aster concolor* with four similar congeners.*

Species	Stem	Inflorescence	Leaf	Ligule	Fruit	Habitat	Range	Flowering
Aster concolor L. Eastern silvery Aster	Slender, simple, or sparingly branched, thinly sericeous or sometimes merely strigose, rarely spreading villous, glabrate below	Elongate subsimple virgate, more or less spiciform raceme, or with racemiform branches	Elliptic-oblong to lanceolate, entire, to 5 x 1.5 cm, basal leaves soon deciduous, others sessile and broad-based but not strongly clasping, sericeous, sometimes glabrate with age, greatly reduced above	8(10-15)16, lilac, < 1 cm	Achene densely sericeous, the pubescence obscuring the nerves	Dry sandy places, often among pines	Coastal states from MA to FL and LA and up the Mississippi embayment to sw TN; less commonly inland in the mountains of KY and TN	Late August to November
Aster sericeus Vent. Western silvery Aster	Slender, erect, glabrous mostly with stiff ascending branches	Few heads at tips of branches, open and corymbiform panicle	Lance-ovate to oblong or elliptic, to 4 x 1 cm; basal lvs oblolanceolate and petiolate but soon deciduous, other only slightly or not at all clasping; sericeous, entire	15-30, purple-violet, 1-1.5 cm	Achenes glabrous, closely 8-12 nerved	Dry open woods, bluffs and prairies	Northern MI to s. Manitoba and ND, s to TX, MO, and irregularly e. in TN	August to October
Aster patens Ait. Clasping Aster, Skydrop Aster	Scabrous, puberulent, rather slender and brittle, usually simple up to the inflorescence; arise from short caudex, sometimes with creeping rhizomes	Divergent to subascending branches, bracts flat and like reduced leaves, involucre puberulent and glandular with 3-4 series of firm, scarious oblong	On primary stem divergent, cordate-auriculate clasping bases, oblong to oval, blunt to mucronate, entire 2-7 cm	20-30, blue (pink) ~1 cm	Unknown	Dry open woods, clearings, and fields	Central ME to MN, s. to FL, AL, MS, LA, and TX	August to October

Table 1. Comparison of *Aster concolor* with four similar congeners.*

Species	Stem	Inflorescence	Leaf	Ligule	Fruit	Habitat	Range	Flowering
		phyllaries with spreading green tips						
Aster spectabilis Ait. Showy Aster	Rhizomatous; stems usually densely glandular	Open, corymbiform, sparsely leafy-bracteate, glandular involucre bract broad and firm with spreading green tip	Basally disposed, lowest petioled and lanceolate, oblong-spatulate or narrowly ovate, entire or remotely and shallowly toothed	~20, bright violet, 1.5-2 cm	Achenes short and hairy	Dry sandy soil, often among pines; open woods and clearings	Eastern MA to DE and MD, w. to NC	August to October

*A third silver aster, *A. pratensis* Raf. =*S. pratensis* (Raf.) Nesom, the barrens silver aster, formerly considered a variety of *A. sericeus*, co-occurs with *A. sericeus* in the south (see USDA Plants national database website).

Two other similar species, *Aster patens* (skydrop aster) and *Aster spectabilis* (showy aster) often co-occur with *Aster concolor* on Nantucket. Unlike *Aster concolor*, they have bright blue to violet-blue ligules or ray flowers. These three species have flowering periods that overlap, and *Aster patens*, in particular, intergrades with and can hybridize with *A. concolor* (see Table 1). Since *Aster patens* is more common than *Aster concolor* there can be some risk from hybridization.

SPECIES BIOLOGY

The biology of *Aster concolor* remains largely unknown. A congener, *Aster curtus*, Cronq., which is endemic to glacial outwash in Washington state and Vancouver, BC, Canada, has been studied to determine whether self-incompatibility plays a role in its rarity. The authors determined experimentally that the species is partially self-compatible, and their results suggest that its reproductive biology doesn't contribute much to that taxon's rarity (Giblin and Hamilton 1999). They then argue that understanding why *A. curtus* is rare has important implications to the conservation of the glacial outwash prairie where it is considered an indicator species. This likely is true also for island populations of *Aster concolor*, which is restricted to and rare within the sandplain grasslands/coastal heathlands of Nantucket and which has disappeared from the other isolated portions of its range.

The New England Wild Flower Society's propagation records for two seed collections from the Nantucket *Aster concolor* populations showed some evidence that fecundity may be low. Less than half of the seeds were full or mature, and germination of those selected for planting was less than 50%, thus overall viability of seed was less than 25%. Not all seedlings survived, but those that did matured and bore fruit the following year. After three seasons, plants were set out in the rare plant garden. According to New England Wild Flower Society Rare Plant Curator, Chris Mattrick, individual plants seemed to be short-lived perennials in cultivation, surviving for only about three to four years (personal communication). If this information holds true for plants in their natural habitat, it could explain the somewhat transitory nature of the localized element occurrences (EOs) on Nantucket, apparent comings and goings being dependent on seed set within suitable habitat within searchable distance of a senescent colony. Thus, the size and distribution of a particular *Aster concolor* EO might show a 3-5 year periodicity. Several clones or patches flagged and monitored annually on Nantucket have persisted for five years and may in the future provide useful information on longevity. The extent of each patch seems to vary from year to year subject to, for example, seasonal differences in rainfall and impacts of herbivory.

Research for this plan included examining specimens at Harvard University Herbaria (HUH), which revealed that although only one specimen label made specific reference to fire, at least seven of the nearly one hundred specimens examined had charred stubs of stems (~2cm length) arising from the caudex. These plants all bore one or two exemplary wand-like flowering stems and likely were selected for their particular beauty. Many additional specimens

appeared to have a coating of soot on roots and/or at the base of the stem. Such growth indicates a two-stage response to fire, with vegetative regeneration and profuse flowering followed by seedling production in the fire-readied seedbed (Miller and Findley 1994). This herbarium specimen evidence supports the characterization of *Aster concolor* as a fire-adapted grassland species.

Burn specialists Caren Caljouw and Peter Dunwiddie (formerly of Massachusetts Audubon Society) have both reported that *Aster concolor* was avoided or too few in numbers to be included within experimental burn plots at Nantucket, although other Asters were included (Dunwiddie 1998). Thus the Nantucket populations' response to experimental controlled burning remains unknown, even though their results indicated that asters generally increase in cover and frequency with repeated burning (P. Dunwiddie, personal communication).

HABITAT/ECOLOGY

Fogg, in his 1930 report on the origins of the flora of the Elizabeth Islands, noted Fernald's observation that certain species endemic to the coastal plain of the Eastern US occur in New England only on glacial outwash deposits. These deposits support relict southern flora species that "have persisted outside the subsequently glaciated area, finally taking possession of their present isolated habitats on the receding of the ice" (Fogg 1930: 219). Fogg concluded that the Elizabeth Islands, like the moraine deposits of Cape Cod, Martha's Vineyard, and Nantucket, were formed by the Wisconsinan ice sheets. He noted, however, that the Elizabeth Islands "take their place botanically as an extension of the adjacent mainland rather than as a link in that chain of outposts of a formerly continuous but now highly disrupted coastal plain flora extending from the South Atlantic States to Newfoundland" (Fogg 1930: 220). *Aster concolor* is one of the species with coastal plain affinity that have been recorded only from the "outpost" areas off southern New England. The species was never recorded from the Elizabeth Islands nor from the mainland north of Rhode Island and southeastern Mass.

Bicknell, in his series "The Ferns and Flowering Plants of Nantucket," also followed up on Fernald's idea noting that "the southern coastal plain flora had become a primary element in the general composition of the flora" (Bicknell 1919: 434). He found great affinity of the Nantucket plains flora with that of the Hempstead Plains of Long Island and with the New Jersey Pine Barrens and coastal plain. He listed *Aster concolor* among 32 of the 36 characteristic Nantucket plains species that also occur on the Hempstead Plains.

Even today, *Aster concolor* occurrences on Nantucket Island (Island) are restricted to soils formed from glacial outwash, Evesboro association EvA/EvB, (USDA Soil Conservation Service 1979). Most localities are at least a mile south of what was the ice-front position during moraine formation (Miacomet Golf Course DEIR 1997, Oldale1985).

By the late 1960's, when recent botanical investigations were begun, *Aster concolor* had become rare on Nantucket. It was not included in MacKeever's (1968) "Catalogue of the Native and Naturalized Plants of Nantucket," which was based on his own collection of the Island flora. Jenkins (1982) recorded it as a "rare plant of the moors." Sorrie (1987) reported that "most current stations…contain relatively few plants per site." Sorrie and Dunwiddie (1996) listed it as "occasional in coastal heathlands and sandplain grasslands."

The species is now recognized as an endangered component of an endangered plant community, Sandplain Grassland and/or Coastal Heathland, a mosaic of grass-dominated and shrub-dominated plant associations (Barbour et al. 1998). The habitat on Nantucket is nearly all that remains on what Fernald described as the outposts of the glaciated coastal plain (those outposts also include Martha's Vineyard, Rhode Island, and Long Island to the south and west.) The high-diversity native sandplain grassland community is ranked S1 Endangered in Massachusetts and includes a distinctive association of primarily coastal taxa including 21 regionally and globally rare plant species (Dunwiddie et al. 1996). This fire-maintained plant community is typically open and is visually dominated by grasses, although forbs and shrubs are important components (Swain 1999). Following an extended period of nearly complete fire suppression on the Island the fire-adapted components of the remaining sandplain grasslands have become rare. *Aster concolor* has been found only as remnant colonies. Most of these are near the shore and in grassy openings, along road edges and former fence lines, in those few places where it seems to have survived development, grazing pressures, and successional overgrowth.

A summary of 20m diameter study plots termed "checklist plots" analyzed within six of nine known *Aster concolor* occurrence sites studied in 1983, revealed that these sites had the highest number of species for any group of plots sampled on Nantucket. Most sites were within 10 meters of a road, indicating that periodic disturbance is beneficial to the plants. In his report on this study, Zaremba (1984) noted that good indicators for *A. concolor* habitat include: *Schizachyrium scoparium*, *Carex* spp., *Festuca* spp., *Aster patens*, *Aster dumosus*, *Aster paternus*, *Ionactis linariifolius*, and *Linum intercursum*, all components of sandplain grasslands. Fire effects are hypothesized for at least one of these sites, where open grassland once was burned and maintained for golf.

THREATS TO TAXON

The major threats to survival of *Aster concolor* in its one remaining New England stronghold on Nantucket are:

- habitat destruction due to development
- habitat degradation due to succession to dense shrubland resulting from fire suppression and secondarily from cessation of grazing
- invasive exotics, in some areas
- herbivory and seed predation

- isolation and fragmentation of remaining sizeable habitat, which may result in small population size and limit viability

Development pressures on Nantucket continue to be a major threat, even though heathlands are a priority for land acquisition and habitat protection. A particular dilemma on the Island is the conflict between the demand for use of open space lands for active recreation (especially golf courses) and the need for protection of globally rare plant communities. The Nantucket Land Bank, for example, has a dual mandate to both acquire land that will provide recreational opportunities for islanders and at the same time to protect from development the lands that give the island its natural beauty and character. Road widening, and bikeway and pipeline construction are also noted threats to individual EOs. Examination of the EO data provided by the Natural Heritage Database indicates that seed collection and transplantation, as mitigation for roadway/bikeway disturbance, may not be beneficial to *Aster concolor* on Nantucket. For example, at EO MA .002 and .010 (sub-population .004), transplanted seedlings did not persist for more than a year or two.

Early last century Bicknell (1919: 429), described the threats to the Nantucket grasslands of the "dry plains" as invasions from the east by barrens scrub oak and "midway in the island by open formations of young pitch pines advancing from denser growths that earlier made their conquest." He recognized the inevitable plant community succession that was taking place following the end of sheep grazing and with suppression of fire. Harper (1991) later reported that huckleberry clone expansion in particular had been accelerating with time, increasing by 21 to 30% between 1938 and 1975, and doubling between 1975 and 1990. A direct effect of an increase in cover, height, and stem density was a decrease in species richness, presumably a result of shading. Today, the threat of plant community succession still exists.

Herbivory by mammals (deer, rodent, and rabbit) may be a problem for the taxon, especially where it is restricted to a few plants in a few remaining patches of suitable habitat. Buckley Botanical Consultants (1999) noted evidence of the detrimental effects of herbivory. A decline in propagated plants following pruning (artificial herbivory) was observed by Chris Mattrick at NEWFS. If late-season browsing reduces fecundity, perhaps in part because it limits time for re-growth and flowering response, protection from herbivores may be required. Some success with use of exclosures on Nantucket has been achieved for *Prenanthes serpentaria*, another late-blooming member of the Asteraceae (personal observation, and Bruce Perry, Nantucket Land Bank, personal communication).

Insect seed predation may be another factor limiting the plant's reproductive success. Bertin and Kerwin (1998) speculate that because of larval insect predation, gynomonoecy (the presence of both female and bisexual flowers on the same capitulum) could be advantageous to the asters. Flower counts from their study indicate that ray flowers (female) were much less likely to be insect-damaged than were disk flowers. If seed production were dependent upon the presence of undamaged ray flowers, it is possible that the low number of ray flowers in *A. concolor* also might limit fecundity of an individual plant.

Population sizes of *A. concolor* populations are small enough to cause loss of genetic diversity through inbreeding and genetic drift (Barrett and Kohn 1991, Ellstrand and Elam 1993). Further, reproduction may be limited in small populations due to inbreeding depression or due to lack of compatible mating types if *A. concolor* is self-incompatible. However, nothing is known of the breeding system or reproductive success of this plant. Thus, to determine more fully the reasons for its rarity within the plant community and to enable proper management, such factors as self-compatibility, the role of pollinators, and the relationship between population size and seed set need further investigation.

DISTRIBUTION AND STATUS

General status

The Global Rank of *Aster concolor* is "G4?" and its National Rank is "N4,"(The Nature Conservancy and Association for Biodiversity Information 1999), which means that the species is thought to be secure, both globally and nationally. However, its actual status varies from state to state throughout its range. The Association for Biodiversity Information database (Natureserve 2001, Kartesz 1994, Kartesz 1999) includes *Aster concolor* records from sixteen states, among which only North Carolina lists *Aster concolor* as S5, with a secure, stable population (Table 2 and Figure 1).

Aster concolor is a component of the Atlantic coastal plain flora. This plant biome extends east and south of the fall line, "a line joining the waterfalls on numerous rivers that marks the point where each river descends from the upland to the lowland and the limit of navigability of each river" (Mish 1986). The fall line is generally the topographic boundary between piedmont and coastal plain. The biome reaches from Newfoundland to southeast Texas. The range of *Aster concolor* is more restricted, extending from Massachusetts to Florida and Louisiana and up the Mississippi embayment to southwest Tennessee. There are a few additional records from the mountains of Kentucky and Tennessee (Gleason and Cronquist 1991).

The Harvard University Herbaria (including GH, NEBC; now HUH) contain many *Aster concolor* specimens collected from throughout its range, mostly early in the twentieth century. The collections are somewhat reflective of the taxon's range and abundance and indicate a widespread distribution in the south, particularly South Carolina and Florida.

Fernald's (1937: 630) *Rhodora* article titled "Plants of the Inner Coastal Plain of Virginia," described finding *Aster concolor*, "now beautifully flowering…very abundant, both in the dry clay above and in the damper clay and peat of the bog. Very variable in size of leaf, it led us to hope that the variation is significant; but apparently it is not." Fernald (1950: 1430) described a hairy-stemmed "forma *lasiocaulis* in damper soil." Along with differences in morphology, Fernald's findings indicate possible differences in the habitat requirements of the

southern coastal plain populations or, more likely, a microhabitat requirement for soil moisture. Moisture requirements may be less obvious in the northeast where maritime winds can bring moisture in the form of fog to otherwise xeric soil conditions. (See also Bruce Sorrie's note on Carolina populations, below.)

Peter Kalm's type locality for *Aster concolor* was in Eastern Virginia, where habitat management is now being carried out on military bases. Prescribed burning is used to reduce wildfire hazards, and frequently burned oak savannas at Fort A. P. Hill and Fort Pickett are distinguished by their abundance of *Aster concolor*. Fire frequency in these areas is about every five to ten years, but some areas are burned even more frequently (Caren Caljouw, Conservation Biologist, personal communication).

Aster concolor is known to be widely distributed in the Carolinas and throughout the Southeast -- stable (S5) in North Carolina and SR (recorded) in the other states. It occurs mostly in the coastal plain and piedmont regions, and is rare to uncommon in the mountains. In the piedmont, disturbances such as cutting, mowing, and power line right of way management keep relatively open habitats that were formerly grazed by buffalo or burned, both naturally and by Native Americans. On the coastal plain, fires every two to five years provide the optimum habitat. Because only a small percentage of landowners burn anymore, *Aster concolor* is less common now than formerly. It is generally uncommon, and seldom exceeds numbers in the hundreds. Habitats were originally pine-oak-grass-dominated woodlands and savannas. *Aster concolor* occurs in dry to mesic, not xeric, acid soil conditions with some nutrients (Bruce Sorrie, personal communication).

In New Jersey, there are more than 80 historical sites. However, according to the New Jersey State Botanist, David Snyder, there are only about eight extant occurrences. Most of these are roadside occurrences, and they remain unprotected and unmanaged. The species is in "severe decline," with plant numbers fewer than 50 at each of the current sites. Snyder believes that since *Aster concolor* is missing from suitable habitat at historic sites, fire suppression is not the only factor contributing to its loss (David Snyder, New Jersey Natural Heritage Program, personal communication). It is possible that the species historically existed in a regional metapopulation with continual shifting of populations as suitable habitat created by fire was colonized and older populations died out. Today, remaining populations may be too distant to colonize otherwise suitable habitat. Unfortunately, nothing is known of current population structure, much less historic structure.

On Long Island, New York, there are 30 historical sites, but only one known current site remains, a sandpit, where Robert Zaremba discovered the population. This occurrence reflects the ability of fire-adapted grassland species to occupy human-disturbed areas. It also indicates presence of a seed bank (Robert Zaremba, The Nature Conservancy, personal communication).

Although the coastal plain extends into SE Texas, no Texas records appear in the TNC database, and no specimens were found in the collections examined for this study. TNC botanists presently working in Texas did not find *Aster concolor* records in state literature (Paul Cavanagh, The Nature Conservancy, personal communication).

Table 2. Occurrence and status of *Aster concolor* in the United States based on Information from Natural Heritage Programs.

OCCURS & LISTED (AS S1, S2, OR T &E)	OCCURS & NOT LISTED (AS S1, S2, OR T & E)	OCCURRENCE UNVERIFIED	HISTORIC (LIKELY EXTIRPATED)
Massachusetts (S1; E): 6 current and 9 historic occurrences	North Carolina (S5): locally common	Alabama (SR)	Rhode Island
New York (S1)	South Carolina (SR)*	Georgia (SR)	Delaware
New Jersey (S2)	Tennessee (SR)**	Florida (SR)	District of Columbia
Maryland (S1)		Louisiana (SR)	
Kentucky (S2)		Mississippi (SR)	
		Virginia (SR)	

*Occurrence verified by Bruce Sorrie, personal communication.

**Occurrence verified by Ronald Jones, personal communication

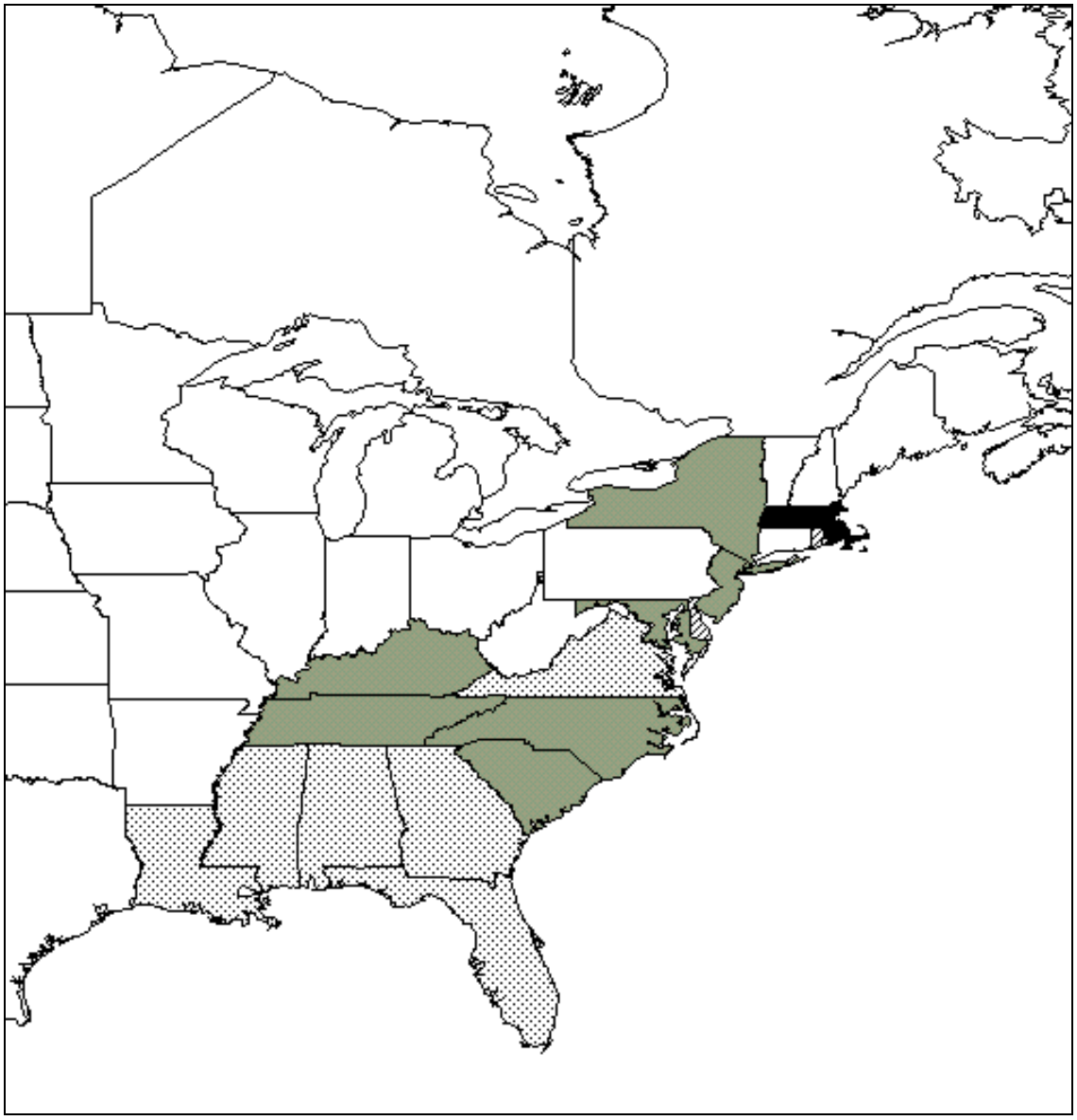

Figure 1. Occurrences of *Aster concolor* in North America. States with gray shading have one to five confirmed, extant occurrences of the taxon. Massachusetts, shaded in black, has the only New England occurrences. Although whole states are shaded, note that Massachusetts and New York populations are all on off-shore islands. Stippled states are ranked "SR," where the taxon is reported but has not been verified by the Association for Biodiversity Information (see Appendix for explanation of state ranks).

Figure 2. Extant occurrences of *Aster concolor* in New England. Town boundaries for southern New England states are shown. Nantucket, shaded in black., has more than five extant occurrences of the taxon.

Figure 3. Historic occurrences of *Aster concolor* in New England. Shaded towns have one to five historic records for the taxon.

New England Occurrence Records for *Aster concolor* based on data from State Natural Heritage Programs. Shaded occurrences are considered extant.

State	Element Occurrence Number	County	Town
MA	.001	Nantucket	Nantucket
MA	**.002**	**Nantucket**	**Nantucket**
MA	**.003**	**Nantucket**	**Nantucket**
MA	.006	Nantucket	Nantucket
MA	.007	Dukes	Edgartown
MA	.008	Dukes	Edgartown
MA	.009	Dukes	W. Tisbury
MA	**.010 .004**	**Nantucket**	**Nantucket**
MA	**.010 .005**	**Nantucket**	**Nantucket**
MA	**.010 .010**	**Nantucket**	**Nantucket**
MA	**.010 013**	**Nantucket**	**Nantucket**
MA	**.010 .018**	**Nantucket**	**Nantucket**
MA	**.011**	**Nantucket**	**Nantucket**
MA	.012	Plymouth	Wareham
MA	.014	Nantucket	Nantucket
MA	.015	Nantucket	Nantucket
MA	**.016**	**Nantucket**	**Nantucket**
MA	**.017**	**Nantucket**	**Nantucket**
RI	.001	Washing-ton	South Kingstown
RI	.002	Washing-ton	Charlestown
MA	.001	Nantucket	Nantucket
MA	**.002**	**Nantucket**	**Nantucket**
MA	**.003**	**Nantucket**	**Nantucket**
MA	.006	Nantucket	Nantucket

New England Occurrence Records for *Aster concolor* based on data from State Natural Heritage Programs. Shaded occurrences are considered extant.

State	Element Occurrence Number	County	Town
MA	.007	Dukes	Edgartown
MA	.008	Dukes	Edgartown
MA	.009	Dukes	W. Tisbury
MA	**.010 .004**	**Nantucket**	**Nantucket**
MA	**.010 .005**	**Nantucket**	**Nantucket**
MA	**.010 .010**	**Nantucket**	**Nantucket**
MA	**.010 013**	**Nantucket**	**Nantucket**
MA	**.010 .018**	**Nantucket**	**Nantucket**
MA	**.011**	**Nantucket**	**Nantucket**
MA	.012	Plymouth	Wareham
MA	.014	Nantucket	Nantucket
MA	.015	Nantucket	Nantucket
MA	**.016**	**Nantucket**	**Nantucket**
MA	**.017**	**Nantucket**	**Nantucket**
RI	.001	Washing-ton	South Kingstown
RI	.002	Washing-ton	Charlestown

CURRENT CONSERVATION MEASURES IN NEW ENGLAND

The Nantucket Heathlands Partnership has taken steps not only to preserve habitat but also to manage it for rare species protection. The Partnership's adoption of the Open Lands Code, a public awareness campaign developed to safeguard the Island's natural resources, was a significant first step towards the Aster's protection. As mentioned above, specific plans for habitat management are being developed for Nantucket Conservation Foundation and Massachusetts Audubon Society properties.

The Nantucket Land Bank Commission has begun mowing certain heathland areas to slow succession to maritime shrubland. Having recorded individual rare plant locations with a global positioning system (GPS) registered with the Town's latest aerial orthophotos, the Nantucket Land Bank is in a good position to avoid impacts of development on those particular occurrences and their rare habitats. Thus the Land Bank has an opportunity to implement management plans that will benefit Nantucket populations of rare sandplain species including *Aster concolor*.

While non-native invasives have not been a problem in the undeveloped heathlands, introduced species are often common in the agricultural and managed grassland areas of Nantucket. Land Bank land manager Bruce Perry has been actively removing woody invasive species, such as *Elaeagnus umbellata* and *Pinus thunbergii*, and successional trees, such as *Juniperus virginiana*, from some of the grassland areas where regular but infrequent mowing has been instituted.

During the 1980's, Massachusetts Audubon Society researchers conducted experimental prescribed burns in the coastal heathlands. Because of *Aster concolor*'s rarity these efforts did not involve studies of this particular species (Peter Dunwiddie, personal communication). Like the other owners of Nantucket heathlands, the Nantucket Land Bank Commission, working with The Nature Conservancy, is currently investigating a burn plan for some of the Land Bank properties (Eric Savetsky, personal communication).

As mentioned above, some seed banking and propagation efforts have been made by the New England Wild Flower Society's Conservation Program.

II. CONSERVATION

CONSERVATION OBJECTIVES FOR THE TAXON IN NEW ENGLAND

Restoration of *Aster concolor* as a regular feature of the restored sandplain grassland/coastal heathland communities of Nantucket is the main achievable goal of this plan. Reestablishment of populations on Martha's Vineyard and in Washington County, Rhode Island is a secondary goal that would help to ensure the species survival in New England. Potential for reintroduction to historic localities depends on identification and restoration of suitable habitat that can be managed for *Aster concolor* along with its associated plant community, and on knowledge of the population dynamics of the species.

The conservation objectives for *Aster concolor* are to maintain at least ten occurrences with between 250 and 500 individuals, with demonstrable natural recruitment (seedling production) to each occurrence. This would restore at least the historic number of occurrences on Nantucket and nearly double the current number. Occurrences should be configured as clusters of colonies in which dispersal can occur among patches in a cluster, but then different clusters provide redundancy to protect against stochastic events. Of the six current occurrences on Nantucket, only one has reached 500 individuals, and all have fluctuated in size, with several declining from hundreds of individuals to zero. Most occurrences have persisted for the twenty-year period that they have been followed, but two of them are presumed extirpated by development and/or successional overgrowth. Several marked individuals have been observed flowering annually for at least five years, but no recruitment of new plants to these colonies is apparent. Element Occurrence or population sizes appear to be dwindling and may be too small to maintain viability on the Island; thus, habitat management for *A. concolor* will be crucial, and augmentation or reintroduction to other Island and mainland sites may be needed. Likewise, reintroduction to historical locations on Martha's Vineyard and the mainland should be considered, but only after Nantucket populations are secure and a thorough review of the rationale and bio-ethics of doing so is completed.

Long-term management of suitable habitat at the sites listed above will help to assure that *Aster concolor* populations will be maintained. This management must be specifically designed for disturbance-related, fire-adapted grassy heathland species, and based upon knowledge of *Aster concolor*'s biology and habitat requirements.

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IV. APPENDICES

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1. New England Herbarium specimens examined.

2. Non-New England specimens examined at Gray Herbarium, with evidence of fire effects.

3. *Aster concolor* colonies at EO # 010 (sub-populations formerly EO # 004 and "018").

4. An explanation of conservation ranks used by The Nature Conservancy and the Association for Biodiversity Information

1. New England Herbarium specimens examined

NMMA (Maria Mitchell Herbarium), Nantucket, MA:

1. Commons. Nellie F. Flynn, 21 September 1902.
2. Commons near Miacomet. Grace Brown Gardner, 11 September 1915

GH (Gray Herbarium) New England collection:

1. EO #009. 1 mi from W. Tisbury, road to Edgartown, MV. Coll. G.G. Kennedy, 25 Sept. 1896. From C. E. Faxon. Herbarium given to GH in 1910. [Beautiful entire specimen with full inflorescence; stem is pubescent. (photographed by mjd, 31 January, 2000)]

2. EO #009. Along Edgartown Rd., W. Tisbury, MV. Coll. F.C. Seymour, 5 Sept. 1916. Flora of Martha's Vineyard, MA (Determined at and distributed from the Gray Herbarium).

3. EO #008. Along road thru "The Plains", Edgartown, MV, 11 September 1917. Coll. F. C. Seymour #1544. One stem with branched infl., heads small on delicate branches with very reduced leaves (<.5cm length) on reduced branchlets, leaves slightly scabrous at edges, not silvery, sessile, not clasping.

4. Nantucket, MA. Coll. Mrs. M. L. Owen, Sept. (1897 crossed out) 1907.

5. EO #010?, 016?, 017? Moors, Nantucket, MA. Coll. Walter Deane, 10 Sept. 1885. Entire specimen with inflorescence.

6. EO #001? (1) Border of Oak Woods, Kingston, RI. Coll. G.H. Leland, 4 Oct. 1883.

7. EO #001 (2) S. Kingstown, RI. Coll. Miss Lydia Barstow. Two specimens. (on sheet in Florida folder with two specimens collected by H.W. Chapman). Typical of New England specimens.

NEBC (New England Botanical Club) collection:

1. EO #012. Sandy loam, edge of thicket, Wareham, MA. Coll. C. A. Robbins, 26 Sept. 1926.

2. EO #009. Roadside, West Tisbury, MA. Coll. G. G. Kennedy, 25 Sept. 1896. [Author's note: this is an exemplary specimen; branching just above ground at approx. 1cm from "cut" stems.]

3. EO #009. MV, MA. Coll. G. G. Kennedy, 25 Sept. 1896.

4. EO #007. Chappaquiddick, Edgartown, MV, MA. Coll. S.N.F.Sanford. 15 Aug. 1929. (three species of Aster on sheet).

5. EO #008. Along road thru "The Plains", Edgartown, MV. 11 September 1917. Coll. F. C. Seymour #1544. One stem with branched infl., heads small on reduced branchlets, leaves slightly scabrous at edges, not silvery, sessile, not clasping. Unidentified annotation: "x patens?"

6. EO #006. Near Sankaty head, Nantucket, MA. Coll. E. F. Williams. 20 Sep 1903. Typical.

7. EO #003. Diverse ericaceous moor SW of Altar Rock, N. of Barnard Valley Rd., Nantucket, MA. Coll. B. A. Sorrie #2234. 10 Sep 1983. cf #5 with slightly clasping auriculate lower leaves. Rays an uncharacteristic dark blue purple, stem nearly smooth (x *patens*?) (photographed by mjd, 31 January, 2000)

8. Dry sandy soil, Nantucket, MA. Coll. Nellie F. Flynn. 21 Sep. 1902. cf #5. (see also Maria Mitchell coll.)

9. Moors, south shore, Nantucket, MA. Coll. J. R. Churchill. 7 Sep 1907.

10. EO #014. Polpis Rd., Nantucket, MA. Coll. C.B.Graves. 29 Oct. 1917.

11. EO #002 RI. Kimball Bird Sanctuary, Charlestown, Washington Co., RI. 13 Sept 1924. "rays purple-violet." Coll. J.F. Collins

12. EO #001 (5) RI. Dry, sandy loam, South Kingstown, Washington County, RI. Coll. S.N.F. Sanford #10389, 4 Oct 1925. Large wand-like inflorescence. with lilac rays.

13. EO #001 (4) RI. Lowland pasture, Matunuck, beach road, Washington County, RI. Coll. R.J. Eaton. 18 Sep. 1921. cf #5.

14. EO #001 (3) RI. Dry fields, pastures & roadsides S. Kingstown, between Matunuck Rd. & Wakefield, Washington Co., RI. Coll. J.F. Collins & M.L. Fernald #11447, 5 Sep 1914.

2. Non-New England specimens examined at Gray Herbarium. Bold type indicates evidence of fire effects.

State	County/Town	Characters	Habitat & observations	Date	Collector	Collection #
New York	Suffolk Co, Middle Island	Some evidence of soot at base of stem (photo by mjd on 31 Jan 2000)	Sandy woods	8 Oct 1933	H.K. Svenson	6098
New Jersey*	Camden Co., W. Deptford	Charred stub ~3cm x 1mm	Sandy soil, in woods	20 Sep 1900	Alex MacElwee	1980
New Jersey*	Camden Co., SW Penbryn	Evidence of charring	Border of dry, sandy oak woods	12 Oct 1920	Bayard Long	23694
Delaware*						
District of Columbia	Washington D. C.	No data	No data	No data	No data	
Maryland	Prince Georges		Near Surratsville	29 Sep 1895	M.B. White	
Virginia*						
North Carolina	Harnett Co.	"Rays blue-violet"; narrow inflores-cence.	Common in sandy firebreak on sandhill ~1mi se of Spout Spring; oak-dominated (roots appear soot- and quartz sand-covered)	31 Oct 1955	R.L. Wilbur	5118
N. Carolina	Near Morganton			No date, old	Herb. John A. Lowell	
N. Carolina	Wilson near Astoria	typical	Pine woodland	9 Oct 1938	R.K. Godfrey & T. Kerr	6641
N. Carolina	Nash	Lilac rays	Pineland at Middlesex	9 Oct 1938	R.K. Godfrey & T. Kerr	6647
N. Carolina	Pender	With cm charred stub of stem and two additional flowering stems arising from caudex	Grass-sedge savanna, along US Rte 421 south of Harrell's Store, 1mi from Sampson Co. line; roots bear sand, silt and soot	22 Oct 1948	R.K. Godfrey & W.B. Fox	48718
N. Carolina	Wake Co., Cary	Single stem	Grass-weed border	4 Oct 1937	R.K. Godfrey	
N. Carolina	Brunswick Co, Caswell Beach	Several 1-3.5cm charred stubs of stem; two sturdy stems with heavy inflorescence.	Scrub oak sand ridge; ~3cm caudex; fibrous roots bear quartz sand and soot	15 Nov 1947	R.K. Godfrey	12084

State	County/Town	Characters	Habitat & observations	Date	Collector	Collection #
N. Carolina	Brunswick	Two stems, old stubs	Open, rather dry sandy soil, between Supply and Southport, along Rte 130	29 Oct 1955	H.L. Blomquist	16899
N. Carolina	Lee		Pine woodland near Sanford	14 Oct 1938	R.K. Godfrey	6930
N. Carolina	Scotland		Sand hill 9mi s. of Aberdeen	14 Oct 1938	R.K. Godfrey	6940
N. Carolina	Scotland	Two specimens; each has ~2cm x 1mm charred stub of stem with single sturdy inflorescence	Sandhill 12mi n. of Laurinburg	14 July 1938	R.K. Godfrey	5034
N. Carolina	Biltmore Herb.*		Sandy grounds, Biltmore	18 Sep 1897		36a
N. Carolina	Orange Co., Duke Forest*		Edge of upland rocky woods, Hillsboro sect.	22 Oct 1932	H.L. Blomquist	390
N. Carolina	Ashville		Lookout Mtn.	3 Oct 1897	E.E. Magee	
N. Carolina	Cumberland		Sandy upland pine-oak woods, 2.3 mi southwest of Hope Mills	11 Oct 1957	H.A. Ahles	36601
S. Carolina	Oconee Co.	Flowers blue-purple, disc white; ash-grey herb	SW facing roadside slope between Chattooga River and Mountain Rest, Sumter Natnl. Forest, locally common	23 Oct 1988	S.R. Hill	20084
S. Carolina	Jaspar Co.		Roadside & pine savannah, US Rte 17; just N. of Hardeesville	21 Oct 1974	D.E. Boufford, Melissa Marshall	15870
S. Carolina	Berkeley Co.	"Ligules blue"	Open, sandy woods (pine, oak, hickory, liquidambar, Cornus florida in Francis Marion National Forest, near US Rte 17A, ~3.2mi NE of Macedonia	25 Oct 1970	W.J. Dress	10218
S. Carolina	Florence Co.		Pine woods 10mi N. of Florence	30 Oct 1934	A.N. Leeds	1901

State	County/Town	Characters	Habitat & observations	Date	Collector	Collection #
S. Carolina	Horry Co	"Rays lilac", six ~2cm charred stubs, one stem with inflorescence.	Dry, sandy pinelands, road from Murrell's inlet to Burgess P.O.	19 Oct. 1941	C.A. Weatherby	7130
S. Carolina	Charleston Co.	Base of stem and roots appear sooty, "rays pale magenta pink-purple, disc white. Occ. Wand-like herb."	Santee Coastal Reserve, Washo Res. S. side Santee Gun Club Rd. Powerline crossing, 2.1mi E. of South Santee Rd. Wet sand, low drier ridges, near rd.	6 Nov 1992	S.R. Hill	24533
S. Carolina			Santee Canal	Oct?	illegible	
Georgia	Effingham Co., Statesboro		Four mi. from Clyo, by roadside, Ga Rte 119	24 Oct 1959	John A. Boole, Jr.	1039, two sheets
Georgia	Bartow Co.	Ligules vivid purple somewhat charred at base of stem, sand & soot	Rocky slopes at E. end of Big Pelfry Pond, 4.8 mi E. 35° S of Adairsville	19 Oct 1951	W.H. Duncan	13342
Georgia	Charlton Co., near Folkston	Purple flowers	intermediate pine barrens common	31 Oct 1935	Francis Harper	669
Georgia	McIntosh Co., Darien Junction		Flat pine-barrens, a few miles w. of Warsaw	26 Oct 1940	Don Eyles	7660
Georgia	Dade Co.	Rays 8-13, pale violet	Open oak-pine woods on summit of Lookout Mt., between Lafayette & Trenton; Cumberland Geol. Province, 1900 ft.	12 Oct 1947	Arthur Cronquist	4820
Georgia	Harris Co.		Dry, rocky soil at edge of woods and top of road cut along US 27, n. of RJ190 & 27 on Pine Mt.	23 Oct. 1971	S.B. Jones	21643
Georgia	Walker Co.	Rays 8-16, pale violet	Pine-oak-hickory woods on Taylor Ridge, just n. of Maddox Gap, between Villla now & LaFayette, scattered plants	11 Oct. 1947	A. Cronquist	4791

State	County/Town	Characters	Habitat & observations	Date	Collector	Collection #
Georgia	Chatham Co.	Rays purple, disk white, base of stem sooty; plant appears to be fire-dried	Burned-over area, Red Hill Rd. (timber road; union Bag Camp Paper Corp.)	8 Nov. 1958	Mrs. E.O. Mellinger	
Georgia	Laurens Co.	Rays cyanic, ~13	Coastal plain province, 300ft. Open, grassy pineland, six miles east of Dublin	19 Oct. 1947	A. Cronquist	4867
Georgia	Rockdale	Rays 8-12, pale violet or lavender	Pine-oak woods, 3 mi. north of Conyers	15 Oct. 1947	A. Cronquist	4846
Georgia	Baker	Some evidence of fire-charred stem	Dry oak-pine woods, 3 mi. SW of Newton	14 Oct. 1947	R.F. Thorne	7229
Florida*						
Alabama*						
Tennessee*						
Indiana	Jefferson Co.	Cannot be A. concolor, rays >15, pale; stems branching; glandular pubescence; leaves acuminate	High wooded bluff of Ohio R. at “hanging rock” n. of Madison	23 Sep. 1919	Ch. C. Dean	30, 178
Kentucky	McCreary Co., Pine Knot		Dry, reddish sandy soil in open areas & roadsides	12 Oct. 1940	F.T. McFarland, H.J. Rogers, A.M. Harvill	25
Kentucky	McCreary Co.,		Red sandstone knob, s. of Stearns	28 Aug. 1941	E. Lucy Brown	4196
Louisiana	Washington Co.		Cut-over pine woods at cemetery, N. of La 10 & E. of La 21; in Bogalusa, Sec. 13, T3S, R13E	4 Nov. 1979	R. Dale Thomas, Tim Briley, Nelson Rich, Neil Carroll	69599
Mississippi	Hancock Co.			31 Oct 1954	Delzie Demaree	36296
Mississippi	Jackson Co.		Rich shade	15 Nov 1954	Delzie Demarree	36328
Mississppi	Jackson Co.; P.O. Escatawpa		Small hammocks in pine barrens	25 Oct 1953	Delzie Demarree	34501

Appendix 2 (continued)

*GH Other U.S. occurrences:

New Jersey:

Pine barrens, borders of dry sandy woodlands, border of dry, sandy oak woods, sandy soil in woods.

Several specimens are from New Jersey pine barrens, Middlesex Cty. Burlington Cty, Ocean Cty, Cumberland Cty, Camden Cty, Suffolk Cty, Atlantic Cty. Towns of Lakewood, Atco, Atsion, Pestletown. Berlin, Penbryn, Swedesboro, Hammonton

Examples
Pine barrens, South Amboy, Middlesex. Coll. K.K. Mackenzie #1143. Herbarium of F. F. Forbes. 16 Oct 1904. Typical.

Delaware:

Dry ground. Rehoboth. Coast of Delaware, 9 Sep. 1908. Coll. J. R. Churchill.

Washington, D.C.:

Woods at end of lane from Hechey Rd., District of Columbia, 16 Oct. 1888. Coll. E.S. Burgess. Det. Luc Brouillet, 1988.

"in pratis, haud frequens prope", 23 Sep. 1888. Coll. Th. Holm. Rootstock with thick caudex, fibrous roots.

Virginia:

Nottoway Co, on US 460 a few hundred feet SE of Nottoway/Prince Edward Co. line, 6 Oct 1962. Coll. Ruskin S. Freer. #2654

Sussex Co. Thicket bordering pineland about 2 mi east of Stony Creek, 12 Oct 1938. Coll. M.L. Fernald and Bayard Long #9646.

Prince George Co. Argillaceous and siliceous boggy depressions, about 3 mi se of Petersburg, at head of Poo Run, 18 Oct 1936. Coll. M.L. Fernald, Bayard Long, & R.F. Smart #6898

Prince George Co. dry,sandy woods and clearings about 3 mi se of Petersburg, at head of Poo Run, 18 Oct 1936. Coll. M.L. Fernald, Bayard Long, & R.F. Smart #6896

Greensville Co. open dry sandy pine woods north of Emporia, 14 Oct 1938. Coll. M.L. Fernald & Bayard Long #99647

Greensville Co. sandy clearing north of Emporia, 18 Oct 1936. Coll. M.L. Fernald, Bayard Long and R.F. Smart # 6897.

Isle of Wight Co. white sand of dry pine barrens, south of Lee's Mill. 23 Aug & 2 Sep 1930. Coll. M.L. Fernald and Bayard Long #12863.

Northampton Co. sandy and argillaceous bluff and upper border of beach, Chesapeake Bay, west of Kiptopeke, 14 Oct 1935. Coll. M.L. Fernald, Bayard Long and J.M. Fogg, Jr. #5531.

Alabama:

Several specimens from Torr. & Gray, Flora, N. America collection give no locality. Two per sheet. No date. One represents specimens from Alabama and Georgia.

A photo (1955) from Bailey Hortorium type and historic specimens collected by Kalm. Sheet no. 997.30; neg. no. 7131.

High pineland, Atmore, Ala., 25 Oct. 1930. Coll. F. S. Blanton #7061.
" " " 1932. " " #7061.
Long-leaf pine woods on hill in western edge of Bibb Co., between Pearson and Coline, 19 Oct. 1934. Coll. Roland M. Harper #3285.

Pine woods between Southport and Orange Beach. Baldwin County, 18 Nov. 1948. Coll. Roland M. Harper #4098. Specimen has nearly tuberous caudex at base of cluster of stems. Three shortened (4.5-7cm) **stems appear charred**. Two stems bear inflorescences. Leaves are somewhat rough to touch. Stem is pilose.

Gateswood, Ala. 30 Oct. 1903. Coll. S. M. Tracy #8518.

Florida:

Numerous specimens. Some labeled *A. plumosus* and *A. concolor* v. *floridanus* R.W. Long.

Dry pine barrens, Duval Co., N.E. FL Nov. Coll. A. H. Curtiss. North American Plants #1234.

Pine barrens, middle Florida, no date. Coll. Herb. Chapman?
Specimen with stub of **charred stem** along with one stem bearing inflorescence from bulbous caudex with fibrous roots.

Dry pine barrens near Jacksonville, 1 Dec. 1898. Coll. A. H. Curtiss #6434. Curtiss' Second Distribution of Plants of the Southern United States. Fine, typical specimens in good condition.

New Port Richey, Nov. 1934. Coll. Dana Carpenter.

High pine-turkey oak woods, 2.4 mi. w. of Citra, Marion Co. 13 Nov. 1960. Coll. R. & E. West, 1001. Caudex with rhizome. More typical than some. Longleaf pine, wiregrass sand ridge, 7 miles north of Wewahitchka, Calhoun Co. 15 Oct. 1955. Coll. R. K. Godfrey & R. Kral. Det. Paul L. Redfearn, Jr. #54162 . C.W. James redet. as *A. plumosus* Small. Very bushy specimen with woody stem and narrow needle-like leaves.

Dry, sandy soil. Aspalaga, Oct. 1897. Redet. by C.W. James as *A. plumosus* Small.

Sandhill with Quercus laevis & Q. incarnata. Morris Bridge Rd. just south of #582, Temple Terrace, Tampa. 11 Nov. 1961. Coll. O. Lakela #24840. Stems shrublike at base (cf. Wewahitchka spec. above).

Scrub oak land. Okeechobee region, Brevard Co. 6 Nov. 1903. Coll. A. Fredholm # 6192. Several tall stems from woody base. Caudex, roots and lower stem appear soot-covered. Soil particles of fine quartz sand cling to rootlets.

Low pinelands, few examples, Parker Islands, 5 miles south of Lake Istokpoga, Highlands, Co. 26 Nov. 1945. Coll. L.J. Brass #15715. Herbarium of Archibold Biological Station. Typical.

Dry woods, Winter Park, Orange Co. 19 May 1927? Coll. FWH #10533.

Occasional on loose sand of Llpine-turkey oak flats. 8 mi SSW of Ellaville. Madison Co. 11 Oct. 1957. Coll. R. Kral. #6192. Spectacular specimen. Has **2cm stub of charred stem** (~2.5mm diam.) plus one tall (~1m) sturdy stem (~5mm diam at base) with infl. from woody base.

Disturbed roadside sands bordering longleaf pine-turkey oak woods 4mi W. of Madison., Madison Co. Coll. R. Kral. Note: Specimen examined in revision of Aster section Patentes (Asteraceae). Ronald L. Jones 1979. Vanderbilt Univ. Branching from base of stem above caudex, perhaps as a result of trampling.

Additional specimens labeled *A. concolor* var *simulatus* (Small) Long from Velusia Co., Broward Co., Hillsborough Co. and Dade Co.

Tennessee:

Cumberland Co. Mesic area under powerlines along Hebbertsburg Rd. 3.3 mi north of Crab Orchard. 19 Sep 1992. Coll. V.E. McNeilus. 92-1041.

Cumberland Co. Boggy margin of artificial pond at edge of game refuge about 3 me W. of Genesis. 6 Oct 1949. Coll. RES, FWW, EHC. #14181

Hiwassee Valley, E. TN. Dry woods. 7 Aug.1902. Coll. Albert Ruth.

Nansemond Co. Kilby. Dry sandy woods and adjacent clearings, 11 Sep 1935. Coll. M.L. Fernald, Bayard Long, J.M. Fogg. #5100

3. *Aster concolor* colonies at EO # 010 (sub-populations formerly EO # 004 and "018"). Sites visited between 1996 and 1998 (A. Buckley, Buckley Botanical Consultants).

Date	Site	Plants/ Clumps	Stems	Observations
8/30/96	3c	2		vegetative, likely *A. concolor*
9/5/96	3c	2		confirmed *A. concolor*
9/19/96	3c	>13		9 Flags delimited larger population; 4flags on single plants
9/19/96	9	1		
9/26/96	11	6		central area, grassy heath with *H. dumosum, A. uva-ursi, H. ericoides, V. angustifolium, M. pensylvanica*
9/26/96	11	4	20	between driving range and central area
9/26/96	11 roadside	4		Somerset Rd. island and east edge
10/ /96	3c	8	104	Eight "colonies" found
10/ /96	7	1		One "colony" found
10/ /96	9	1		One "colony" found
10/ /96	11	7	30	Seven "colonies" found
9/17/97	11 roadside	1	1	full flowering
9/17/97	3			AMB photographed
9/18/97	3c original site	2	5	AMB & MJD photographed honey bee pollinator, *A. patens, A. dumosus, A. linariifolius* also flowering; deer bed, *Microtus* tunnels
9/25/97	9	1	7	2 sq.ft area, 25cm ht., with *A. uva-ursi, A. dumosus, Schizachyrium scoparium, H. dumosum, Liatris* nearby
9/25/97	11	1	10	2 sq ft area, 30cm ht., at road edge with grasses and *Euthamia*
9/26/97	shcp			Patches in grassy area at flag #35; numerous in central area both e. & w. of Mioxes Pond, esp. large high plateau area south of Bartlett Farm.
10/16/97	11	2	16	
7/7/98	3	several		Plants trampled or driven over
9/21/98	7 (near plot 2)	1		Browsed, no blossoms
9/21/98	9	1	2	Browsed, 5 buds
9/ /98	3c		103	Plants in area beyond first tee, patch delimited by flagging and individual plants along "fence row"
9/ /98	3c (original)	4	14	Site of first plants observed
9/ /98	3c (fence row)	6	43	
9/ /98	9	2	2	
9/ /98	7	1	1	browsed
9/21/98	3c	5	38	site first flagged in 1996 with two plants
9/21/98	Somerset Farm	2		In field near red cedars, on north facing slope 10-20°slope,
9/21/98	11	several		Plants evident at 1997 flag locations

4. An explanation of conservation ranks used by The Nature Conservancy and the Association for Biodiversity Information

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 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.