

Note

The First Record for Altai Fescue, *Festuca altaica* (Poaceae), in Nova Scotia, from an Eastern Alpine Site on Cape Breton Island

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Altai Fescue, *Festuca altaica* Trinius, is an amphi-Beringian grass species also known from isolated, but widespread, locations in northeastern North America. The occurrence reported here, at the southern limit of eastern alpine habitat in Canada, represents the first for Nova Scotia.

Key Words: Altai Fescue; *Festuca altaica*; conservation; rare plants; floristics; alpine vegetation; Nova Scotia

The distribution of *Festuca altaica* Trinius ranges from the Altai Mountains of central Asia (Tsvelev 1983) eastward and northward across the Bering Sea to northwestern North America and, from there, southward in British Columbia and western Alberta in alpine tundra (Pavlick and Looman 1984; Alexeev 1985; Harms 1985; Darbyshire and Pavlick 2007; Saarela *et al.* 2017). It also occurs in scattered areas in boreal forest and alpine regions of eastern North America, including northern Michigan, Quebec, Labrador, and western Newfoundland (Darbyshire and Pavlick 2007; Figure 1).

Here we document its first known occurrence in Nova Scotia, where a small but well established population was discovered during a qualitative botanical survey north of Polletts Cove, Cape Breton Island (Figure 2), in 2013. Although only a single localized population was found near the edge and crest of the plateau, more sites may well be found in this poorly explored region of fragmented barrens. This site is approximately 150 km and 340 km from the species' nearest locations in western Newfoundland and southeastern Quebec, respectively, which are isolated by ocean water (Figure 1). The plant occurred in small, scattered patches (none larger than a few square metres) over an area of about 50 × 10 m, within a tundra-like grassland, treeless (except for a few scattered krumholtz White Spruce, *Picea glauca* (Moench) Voss) and containing scattered forbs and shrubs. This habitat is classified as eastern alpine vegetation, which is one of the habitats in eastern Canada most vulnerable to environmental and climatic changes (Jones and Wiley 2012; Capers *et al.* 2013).

The scattered meta-populations of *F. altaica* in eastern Canada have sometimes been referred to other taxa

in the taxonomically controversial Rough Fescue complex (section *Breviaristatae*), including Plains Rough Fescue (*F. hallii* (Vasey) Piper; Alexeev 1985) and Mountain Rough Fescue (*F. altaica* subsp. *scabrella* (Torrey) Hultén (= *F. campestris* Rydberg); Harms 1985). As indicated by Pavlick and Looman (1984), populations in eastern North America appear to be most closely linked with *F. altaica* (in the narrow taxonomic sense) through morphological, phylogeographical, and ecological aspects (Darbyshire and Pavlick 2007).

Festuca altaica occupies a wide range of substrates and habitats throughout its range, including sandy plains, rocky slopes, cliffs, and talus in open boreal, subarctic, and subalpine forests, as well as low arctic and alpine tundra. It is often present in serpentine barrens in British Columbia, Quebec, and Newfoundland, but is also present on limestone and Precambrian bedrock (herbarium label data). The northern plateau of Cape Breton Island, where the population occurs at 412–427 m above sea level, is composed of Precambrian igneous and metamorphic rock (Roland 1982; Barr *et al.* 1992). Soil at the site consists of a 6-cm layer of humus over a fine, loamy-textured mineral soil about 20 cm deep.

In 2013, close associates of *F. altaica* and community structure were analyzed in two 25-m² plots within the area where this species is the dominant component. Plot SB1066 was at the crest of the slope on the plateau and SB1216 was on the upper slope (Figure 2, Table 1). The fieldwork was the first botanical exploration of the Polletts Cove plateau, and it documented numerous other provincially rare species with northern affinities both on the plateau and in the adjacent Blair River Valley (Table 2). Taxonomy and nomenclature in the tables follow Brouillet *et al.* (2010+), Esslinger (2015), and Ireland

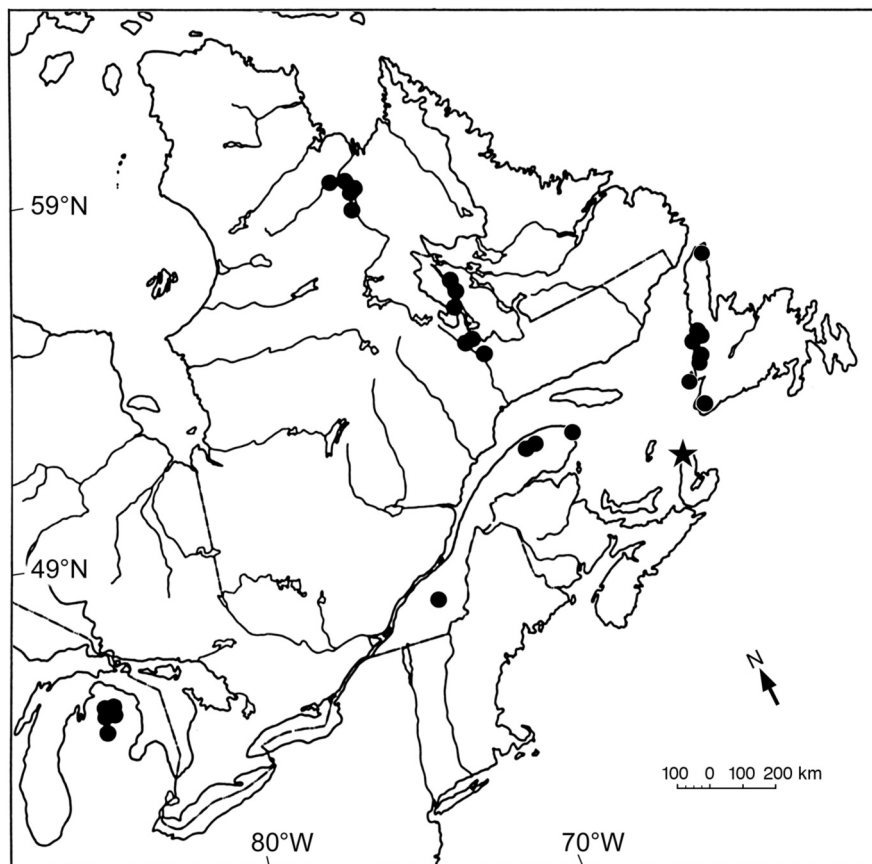


FIGURE 1. Distribution of Altai Fescue (*Festuca altaica*) in eastern North America, including the collection reported here from Nova Scotia (star). Sources: Aiken and Darbyshire (1990) and Atlantic Canada Conservation Data Centre, Sackville, New Brunswick, Canada.

(1982); common names of vascular plants are from Brouillet *et al.* (2010+). Provincial status ranks (S-ranks) in Table 2 were developed using the methods of NatureServe (2017).

The widespread and isolated occurrences of *F. altaica* in eastern North America suggest that current metapopulations are relicts of a more continuous distribution when tundra vegetation followed the glacial margin retreat northward and was subsequently modified by long-term (Hypsithermal) and short-term Holocene climate variation (Roland and Smith 1969; Webb *et al.* 1983; Ritchie 1987; Viau *et al.* 2006; Capers *et al.* 2013). Species of plants (and animals) responded to these changes in complex ways, both as communities and individualistically (Overpeck *et al.* 1992; Henry and Molau 1997; Jump and Peñuelas 2005; Walther 2010). A somewhat similar distribution is seen for Timber Oatgrass (*Danthonia intermedia* Vasey; Cayouette and Darbyshire 1987; Darbyshire 2003). Although this

latter species has not been found in Nova Scotia, both are relatively large-seeded grasses with boreal, arctic, or alpine affinities and no obvious means of long distance seed dispersal.

A combination of character states easily distinguished *F. altaica* from other species of *Festuca* in Nova Scotia in either vegetative or reproductive states. Measurements and observations of the limited material of *F. altaica* available from the Nova Scotia population showed character states well within the range reported for the species as a whole as listed below (Darbyshire and Pavlick 2007). It is a densely tufted grass with plentiful sterile shoots arising from within the persistent old leaf sheaths (intravaginal shoots) and, unlike Red Fescue (*F. rubra* L.) and Proliferous Fescue (*F. prolifera* (Piper) Fernald), creeping rhizomes are absent, although short extravaginal shoots may sometimes be present. Other species of *Festuca* present in Nova Scotia — Hair Fescue (*F. filiformis* Pourret), Nodding Fescue



FIGURE 2. Alpine vegetation on Polletts Cove plateau, Nova Scotia, with Altaï Fescue (*Festuca altaica*) in foreground. A. 15 July 2016. Photo: S. Blaney. B. 4 October 2013. Photo: S. Basquill.

TABLE 1. Percentage cover of vegetation in two plots (25 m²) containing Altai Fescue (*Festuca altaica*) at Polletts Cove plateau, Nova Scotia. The total number of species (and unique species) at plot SB1066 at the crest of the slope and plot SB1216 on the upper slope were 22 (7) and 32 (17), respectively.

Species		Cover, %	
		Plot SB1066	Plot SB1216
WOODY PLANTS			
Green Alder	<i>Alnus alnobetula</i> subsp. <i>crispa</i> (Aiton) Raus	1.50	3.00
Black Chokeberry	<i>Aronia melanocarpa</i> (Michaux) Elliot	0.10	0.03
Beaked Hazel	<i>Corylus cornuta</i> Marshall	— *	0.10
Northern Bush-honeysuckle	<i>Diervilla lonicera</i> Miller	—	0.10
Mountain Holly	<i>Ilex mucronata</i> (L.) M. Powell, Savolainen & S. Andrews	0.50	—
White Spruce	<i>Picea glauca</i> (Moench) Voss (single tree < 0.5 m tall)	0.50	—
Virginia Rose	<i>Rosa virginiana</i> Miller	0.05	0.20
Broad-leaved Meadowsweet	<i>Spiraea alba</i> var. <i>latifolia</i> (Aiton) Dippel	1.00	0.10
Lowbush Blueberry	<i>Vaccinium angustifolium</i> Aiton	15.00	—
Northern Blueberry	<i>Vaccinium boreale</i> I. V. Hall & Aalders	—	1.00
HERBACEOUS PLANTS			
Common Yarrow	<i>Achillea millefolium</i> L.	0.10	0.10
Rough Bentgrass	<i>Agrostis scabra</i> Willdenow	—	0.10
Alpine Bistort	<i>Bistorta vivipara</i> (L.) Delarbre	—	< 0.01
Canada Bluejoints	<i>Calamagrostis canadensis</i> (Michaux) Palisot de Beauvois	15.00	—
Sedge species	<i>Carex</i> sp.	0.02	—
Bluebead Lily	<i>Clintonia borealis</i> (Aiton) Rafinesque	0.10	0.30
Goldthread	<i>Coptis trifolia</i> (L.) Salisbury	—	0.10
Bunchberry	<i>Cornus canadensis</i> L.	0.01	—
Wavy Hairgrass	<i>Deschampsia flexuosa</i> (L.) Trinius	5.00	1.00
Flat-topped White Aster	<i>Doellingeria umbellata</i> (Miller) Nees von Esenbeck	0.50	4.00
Stiff Eyebright	<i>Euphrasia stricta</i> J. F. Lehmann	—	0.10
Altai Fescue	<i>Festuca altaica</i> Trinius	30.00	60.00
Wild Strawberry	<i>Fragaria virginiana</i> Duchesne	—	0.02
Hairy Woodrush	<i>Luzula acuminata</i> Rafinesque	—	0.10
Three-leaved Rattlesnakeroot	<i>Nabalus trifoliolatus</i> Cassini	1.00	0.01
Whorled Wood Aster	<i>Oclemena acuminata</i> (Michaux) Greene	0.50	—
Three-tooth Cinquefoil	<i>Sibbaldia tridentata</i> (Aiton) Paule & Soják	0.03	1.00
Downy Goldenrod	<i>Solidago puberula</i> Nuttall	2.00	0.03
Mountain Cranberry	<i>Vaccinium vitis-idaea</i> L.	0.10	0.10
BRYOPHYTES AND LICHENS			
Stubby Stalked Lichen	<i>Cladonia caespiticia</i> (Persoon) Flörke	—	0.01
Forking Lichen	<i>Cladonia furcata</i> (Hudson) Schrader	—	0.01
Pebbled Pixie-cup Lichen	<i>Cladonia pyxidata</i> (L.) Hoffmann	—	0.01
Wavy-leaved Broom Moss	<i>Dicranum polysetum</i> Swartz	—	0.01
Stairstep Moss	<i>Hylocomium splendens</i> (Hedwig) Schimper	—	1.00
Pellucid Plait Moss	<i>Hypnum imponens</i> Hedwig	—	0.10
Red-stemmed Feather Moss	<i>Pleurozium schreberi</i> (von Bridel) Mitten	0.01	1.00
Yellow-green Rock Moss	<i>Racomitrium heterostichum</i> (Hedwig) von Bridel	—	0.01
Wooly Rock Moss	<i>Racomitrium lanuginosum</i> (Hedwig) von Bridel	—	0.01

*Indicates absence or undetected.

(*F. subverticillata* (Persoon) E. B. Alexeev), and Hard Fescue (*F. trachyphylla* (Hackel) Krajina) — lack rhizomes entirely.

Leaf blade characters are useful for identifying *Festuca* species (Darbyshire and Pavlick 2007). The leaf blades of the sterile shoots of *F. altaica* are conduplicate or convolute (rarely flat), 2–4 mm wide, up to about 50 cm long, strongly scabrous on the abaxial surface, and short pubescent (sometimes sparsely) on the adaxial surface. In cross section, “girders” of sclerenchyma tissue are present at the major veins, extending from the abaxial to adaxial epidermis, while, at the minor veins, “pillars” of sclerenchyma tissue extend from the abaxial

epidermis to the vein. In Nova Scotia, only *F. subverticillata* has sclerenchyma girders, but this species has flexuous leaf blades (3) 5–10 mm wide (see illustrations in Darbyshire and Pavlick 2007) and grows in lowland deciduous or mixed forests.

Lemmas of *F. altaica* are (6.5) 7.5–9.0 (12.0) mm long with a terminal awn to about 1.5 mm long, whereas the lemmas of *F. filiformis* and *F. subverticillata* are shorter (≤ 4.5 mm long) and lack awns. The lemmas of *F. trachyphylla* are 3.8–6.5 mm long and awned. Anthers of *F. altaica* are 2.6–4.5 (5) mm long, whereas the anthers of *F. filiformis* and *F. subverticillata* are ≤ 2.2 mm long and those of *F. trachyphylla* and *F. rubra* are

TABLE 2. Additional significant species at the Polletts Cove site and the Blair River ravine, Nova Scotia.

Species		Affinity	Status in Nova Scotia, [†] no. known sites [‡]
Cream-flowered Rockcress	<i>Arabis pycnocarpa</i> M. Hopkins	Widespread	S1S2, 7
Field Wormwood	<i>Artemisia campestris</i> L.	Boreal	S1, 2
Bog Birch	<i>Betula pumila</i> L. var. <i>pumila</i> *	Boreal	S2, 11
Alpine Bistort	<i>Bistorta vivipara</i> (L.) Delarbre*	Arctic/alpine	S1, 2
Hair-like Sedge	<i>Carex capillaris</i> L.	Boreal, arctic/alpine	S2, 13
Single-spike Sedge	<i>Carex scirpoidea</i> Michaux subsp. <i>scirpoidea</i>	Arctic/alpine	S2, 13
Laurentian Bladder Fern	<i>Cystopteris laurentiana</i> (Weatherby) Blasdel	Eastern	S2, 10
Rock Draba	<i>Draba arabisans</i> Michaux	Eastern	S2, 16
Meadow Barley	<i>Hordeum brachyantherum</i> Nevski	Western (also northwestern Newfoundland and southern Labrador)	S1, 2
Spiked Woodrush	<i>Luzula spicata</i> (L.) de Candolle*	Boreal	S1, 4
Highland Rush	<i>Oreojuncus trifidus</i> (L.) Závěská, Drábková & Kirschner*	Eastern	S2S3, 18
Saint John River Locoweed	<i>Oxytropis campestris</i> var. <i>johannensis</i> Fernald	Eastern	S1S2, 5
Glaucous Bluegrass	<i>Poa glauca</i> Vahl*	Boreal	S2S3, 20
Nodding Saxifrage	<i>Saxifraga cernua</i> L.	Arctic/alpine	S1, 1
Purple Mountain Saxifrage	<i>Saxifraga oppositifolia</i> L.	Arctic/alpine	S1, 2
Laestadius' Saxifrage	<i>Saxifraga paniculata</i> subsp. <i>laestadii</i> (Neuman) T. Karlsson	Boreal, arctic/alpine	S2, 16
Multi-rayed Goldenrod	<i>Solidago multiradiata</i> Aiton	Boreal	S2, 10
Quill Lichen	<i>Cladonia amaurocraea</i> (Flörke) Schaerer*	Boreal, arctic/alpine	S1, 1

*Species found in close proximity to Altai Fescue (*Festuca altaica*) on the plateau crest and upper slopes; others were found on cliff or riparian habitats in the adjacent ravine. All species except Nodding Saxifrage (*Saxifraga cernua*) were found during the same 2013 survey that detected *F. altaica*.

[†]Source: Atlantic Canada Conservation Data Centre, Sackville, New Brunswick, Canada. Accessed 1 June 2017.

[‡]Includes the ones reported here.

mostly 2–3.5 mm long, although the anthers of Rock Red Fescue (*F. rubra* subsp. *pruinosa* (Hackel) Piper) may be up to 6.5 mm long. The apex of the ovaries in *F. altaica* is usually sparsely pubescent, but densely pubescent in *F. subverticillata* and glabrous in other *Festuca* species present in Nova Scotia.

Voucher specimens

Canada, Nova Scotia, Inverness Co., 46.927°N, 60.669°W, alpine summit, plateau barren, 18 July 2013, C.S. Blaney, D.M. Mazerolle, and S.P. Basquill 8330. (ACAD, DAO, NBM, NSPM).

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Literature Cited

- Aiken, S. G., and S. J. Darbyshire. 1990. Fescue Grasses (*Festuca* L.: Poaceae) of Canada. Publication 1844/E. Agriculture and Agri-Food Canada, Ottawa, Ontario, Canada.
- Alexeev, E. B. 1985. *Festuca* L. (Poaceae) in Alaska et Canada. Novosti Sistematiki Vysshikh Rastenii 22: 5–35. [In Russian].
- Barr, S. M., R. A. Jamieson, and R. P. Raeside. 1992. Geological map of Northern Cape Breton Island. DP ME 13, Version 2, 2006. Digital version of Geological Survey of Canada map 1752A. Geological Survey of Canada, Ottawa, Ontario, Canada. Accessed 7 June 2017. <https://novascotia.ca/natr/meb/download/dp013.asp>.
- Brouillet, L., F. Coursol, S. J. Meades, M. Favreau, M. Anions, P. Bélisle, and P. Desmet. 2010+. VASCAN, the database of vascular plants of Canada. Université de Montréal Biodiversity Centre, Montréal, Quebec, Canada. Accessed 22 September 2016. <http://data.canadensys.net/vascan>.
- Capers, R. S., K. D. Kimball, K. P. McFarland, M. T. Jones, A. H. Lloyd, J. S. Munroe, G. Fortin, C. Mat-trick, J. Goren, D. D. Sperduto, and R. Paradis. 2013. Establishing alpine research priorities in northeastern North America. Northeastern Naturalist 20: 559–577. <https://doi.org/10.1656/045.020.0406>
- Cayouette, J., and S. J. Darbyshire. 1987 [1988]. La répartition de *Danthonia intermedia* dans l'est du Canada. Le Naturaliste canadien 114: 217–220.
- Darbyshire, S. J. 2003. *Danthonia* DC. Pages 301–306 in Flora of North America North of Mexico, Volume 25: Magnoliophyta: Commelinidae (in Part): Poaceae, Part 2. Edited by Flora of North America Editorial Committee. Oxford University Press, New York, New York, USA.
- Darbyshire, S. J., and L. E. Pavlick. 2007. *Festuca* L. Pages 389–443 in Flora of North America North of Mexico, Volume 24: Magnoliophyta: Commelinidae (in Part): Poaceae, Part 1. Edited by Flora of North America Editorial Committee. Oxford University Press, New York, New York, USA.
- Esslinger, T. L. 2015. A cumulative checklist for the lichen-forming, lichenicolous and allied fungi of the continental

- United States and Canada. Version 20. North Dakota State University, Fargo, North Dakota, USA. Accessed 22 September 2016. <http://www.ndsu.edu/pubweb/~esslinge/cklst/chcklst7.htm>.
- Harms, V. L.** 1985. A reconsideration of the nomenclature and taxonomy of the *Festuca altaica* complex (Poaceae) in North America. *Madroño* 32: 1–10.
- Henry, G. H. R., and U. Molau.** 1997. Tundra plants and climate change: the International Tundra Experiment (ITEX). *Global Change Biology* 3 (Suppl. 1): 1–9. <https://doi.org/10.1111/j.1365-2486.1997.gcb132.x>
- Ireland, R. R.** 1982. Moss Flora of the Maritime Provinces. Publications in botany 13. National Museum of Natural Sciences, Ottawa, Ontario, Canada.
- Jones, M. T., and L. L. Willey.** 2012. Eastern Alpine Guide: Natural History and Conservation of Mountain Tundra East of the Rockies. Beyond Ktaadn, Inc. and Boghaunter Books, New Salem, Massachusetts, USA.
- Jump, A. S., and J. Peñuelas.** 2005. Running to stand still: adaptation and the response of plants to rapid climate change. *Ecology Letters* 8: 1010–1020. <https://doi.org/10.1111/j.1461-0248.2005.00796.x>
- NatureServe.** 2017. Conservation status assessment: identifying threatened species and ecosystems. NatureServe, Arlington, Virginia, USA. Accessed 9 June 2017. <http://www.natureserve.org/conservation-tools/conservation-status-assessment>.
- Overpeck, J. T., R. S. Webb, and T. Webb, III.** 1992. Mapping eastern North American vegetation change of the past 18 ka: no-analogs and the future. *Geology* 20: 1071–1074. [https://doi.org/10.1130/0091-7613\(1992\)020<1071:MENAVC>2.3.CO;2](https://doi.org/10.1130/0091-7613(1992)020<1071:MENAVC>2.3.CO;2)
- Pavlick, L. E., and J. Looman.** 1984. Taxonomy and nomenclature of rough fescues, *Festuca altaica*, *F. campestris* (*F. scabrella* var. *major*), and *F. hallii*, in Canada and the adjacent part of United States. *Canadian Journal of Botany* 62: 1739–1749. <https://doi.org/10.1139/b84-235>
- Ritchie, J. C.** 1987. Postglacial Vegetation of Canada. Cambridge University Press, Cambridge, United Kingdom. <https://doi.org/10.1002/jqs.3390050209>
- Roland, A. E.** 1982. Geological Background and Physiography of Nova Scotia. Nova Scotia Institute of Science, Halifax, Nova Scotia, Canada.
- Roland, A. E., and E. C. Smith.** 1969. The flora of Nova Scotia. Part II. The dicotyledons. *Proceedings of the Nova Scotia Institute of Science* 26: 277–742.
- Saarela, J. M., P. C. Sokoloff, and R. D. Bull.** 2017. Vascular plant biodiversity of the lower Coppermine River valley and vicinity (Nunavut, Canada): an annotated checklist of an Arctic flora. *PeerJ* 5: e2835. <https://doi.org/10.7717/peerj.2835>
- Tsvelev, N. N.** 1983. Grasses of the Soviet Union. Oxonion Press, New Delhi, India.
- Viau, A. E., K. Gajewski, M. C. Sawada, and P. Fines.** 2006. Millennial-scale temperature variations in North America during the Holocene. *Journal of Geophysical Research* 111: D09102. <https://doi.org/10.1029/2005JD006031>
- Walther, G.-R.** 2010. Community and ecosystem responses to recent climate change. *Philosophical Transactions of the Royal Society B* 365: 2019–2024. <https://doi.org/10.1098/rstb.2010.0021>
- Webb, T., III, P. J. H. Richard, and R. J. Mott.** 1983. A mapped history of Holocene vegetation in southern Quebec. *Syllogeus* 49: 273–331.

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