

Rare and Disjunct Plants from Whitemud Falls Ecological Reserve, Northeastern Alberta

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Whitemud Falls Ecological Reserve, located in northeastern Alberta, includes at least six distinct habitats that support a diverse flora; one hundred and ninety-eight vascular plant species (49 families), 57 mosses (24 families), four hepatics (three families) and 35 lichens (seven families) have been recorded to date. Sixteen vascular and six non-vascular plant species present in the area are rare or disjunct in Alberta, and are described with reference to geographic distribution and habitat occurrence within the Reserve.

Key Words: Conservation, environmentally significant areas, plants, range extensions, disjunct species, phytogeography, floristics, Alberta, Canada.

Twelve Ecological Reserves have been established in Alberta in order to preserve representative examples of major provincial ecosystems. Field surveys of these reserves have led to numerous significant records of both vascular and non-vascular plants. This paper discusses several notable records for the Whitemud Falls Ecological Reserve.

Study Area

Whitemud Falls Ecological Reserve was established in 1987 to preserve several ecosystems considered typical of the mixedwood boreal forest in Alberta, and to protect unique geologic and botanical features. The Reserve is located approximately 80 km due east of Fort McMurray, Alberta (56°41'N, 110°05'E; see Figure 1) and is about 900 ha in area. It lies entirely within the confines of the Clearwater River valley. There is no road access to the Reserve, but the river is a popular and historically significant canoe travel route.

The Reserve lies within the Subhumid Low Boreal Ecoclimatic Region, which is characterized by warm summers and cold, snowy winters (Ecoregions Working Group 1989). Aspen-dominated forests on moderately moist sites are typical of this region in Alberta (Strong and Leggat 1981), but within the Reserve Jackpine and aspen communities on dry, sandy soils are most common (Downing and Legris 1987).

Physical and chemical weathering of Devonian dolomites underlying the Reserve has promoted development of karst features (Carrigy 1959; Ozoray 1974). The Clearwater River has likely been a major influence on the development of bedrock features such as caves and rock stacks, which are rare in northern Alberta. Whitemud Falls is itself unusual; waterfalls are uncommon in Alberta east of the foothills and south of the Canadian Shield. Sandy

fluvial and eolian deposits bedrock are present mantling over much of the Reserve. Small wetland areas and intermittent streams occur locally along the valley floor.

Methods

Field surveys conducted over a ten-day period in July 1987 were directed toward the collection of basic ecological data. Vegetation inventories were one component of the survey and focussed on both description of terrestrial vegetation communities within the Reserve and preparation of a comprehensive floral list. Sampling involved the collection of data at intervals along foot traverses throughout the Reserve. These traverses were run across areas of high landscape diversity as determined by preliminary airphoto interpretation of landscape features (vegetation, topography, geomorphology, hydrology) to maximize sampling efficiency. Aquatic environments were not sampled. Vegetation data analysis employed the Braun-Blanquet tabular method (Mueller-Dombois and Ellenberg 1974). Inventory results are reported in Downing and Legris (1987); an abbreviated description of community types and associated environmental conditions is provided below.

Results and Discussion

Table 1 summarizes the rare and disjunct vascular and non-vascular flora known to occur within the Reserve and their associated habitats. Brief habitat descriptions and phytogeographic information for each of the species is provided below.

(1) *Terrestrial habitats within the Reserve*

At least five distinct habitats which support one or more species of rare or disjunct flora occur within the Reserve.



FIGURE 1. Location of Whitemud Falls Ecological Reserve "Study Area" in Alberta.

- (a) *Erosional bedrock features.* Rock exposures, cliffs and gullies adjacent to the Clearwater River provide a variety of microsites. Extremely dry rock faces are dominated by crustose lichens and drought-tolerant mosses, with a variety of vascular and non-vascular species in slightly moister environments, i.e. rock crevices or rock ledges. Deep gullies between bedrock exposures provide moist, cool conditions under which many boreal species flourish. Stunted Jackpine (*Pinus banksiana* Lamb) forests with a Bearberry (*Arctostaphylos uva-ursi* (L.) Spreng.) dominated understory are characteristic of very shallow sandy Brunisolic soils overlying bedrock. Limestone bedrock probably exerts a controlling influence on soil and water chemistry.
- (b) *Dry sand plains and dunes.* Jackpine communities with an understory characterized by Bearberry and lichens (*Cladina* spp.) occur on rapidly drained, mainly south or west facing sites. Green Alder (*Alnus crispa* (Ait.) Pursh), Bunchberry (*Cornus*

canadensis L.) and Feathermoss (*Pleurozium schreberi* (Brid.) Mitt.) are understory associates on moister sites (usually north and east facing slopes).

- (c) *Sandy veneers and blankets mantling bedrock.* Dry aspen (*Populus tremuloides* Michx.) communities with an understory dominated by Bearberry, Prickly Rose and Wild Rose (*Rosa acicularis* Lindl., *R. woodsii* Lindl.) occur on rapidly to well drained thick sand blankets. These sites are not as dry as those occupied by Jackpine/Bearberry/lichen communities on habitats (a) and (b).
- (d) *Wet, poorly drained depressions, often with organic deposits over mineral soils.* Two community types are common in this habitat: shrub-herb communities dominated by willows (*Salix* spp.), River alder (*Alnus tenuifolia* Nutt.), Marsh Reed Grass (*Calamagrostis canadensis* (Michx.) Beauv.) and sedges (*Carex* spp.); and Black Spruce (*Picea mariana* (Mill.) BSP.) communities, with an understory characterized by Labrador Tea (*Ledum groenlandicum* Oeder) and sphagnum mosses (*Sphagnum* spp.).
- (e) *Wet mudflats, banks and small flood-prone terraces along the Clearwater River.* River Alder, willows, Dogwood (*Cornus stolonifera* Michx.) and a variety of forbs are typically found in this habitat.

Habitat diversity has probably contributed to a species-rich flora within Whitemud Falls Ecological Reserve. One hundred ninety-eight vascular plant species (49 families), 57 mosses (24 families), four hepatics (three families) and 35 lichens (seven families) have been noted to date. Sixteen vascular and six nonvascular plant species are rare or disjunct in Alberta and are discussed below. Voucher specimens for all of the rare and disjunct species are at the University of Alberta herbarium (ALTA). The definition of rarity as used by Packer and Bradley (1984) in their checklist of rare plants of Alberta is employed here. Distribution of vascular plant taxa in Alberta is based on distribution maps in Packer (1983) and herbarium records at ALTA.

- (2) *Rare and disjunct vascular plant species*
- (a) *Cordilleran range extensions and disjunctions.* Several species of vascular plants, including *Arenaria capillaris* Poir., *Arnica lonchophylla* Greene, *Asplenium viride* Huds., *Pellaea glabella* var. *occidentalis* (E. Nelson) Butt., *Draba cana* Rydb., *Kalmia microphylla* (Hook.) Keller, have primarily boreal or northwestern montane distributions in North America. In Alberta, they occur primarily in the foothills and the montane zone of

TABLE 1. Rare and disjunct vascular and non-vascular flora of Whitemud Falls Ecological Reserve. Habitat designations (a to e) refer to habitat types discussed in the text. "Range extension" implies an extension of range without a major gap in the range of the species between previously known sites and Whitemud Falls. "Disjunction" implies a significant gap in the range between previously known sites and Whitemud Falls. Disjunctions are also range extensions, but not vice-versa.

	Significance	Habitat
Vascular plant species:		
Cordilleran extensions and disjunctions:		
<i>Arenaria capillaris</i> var. <i>capillaris</i>	Disjunction	(d)
<i>Arnica lonchophylla</i> spp. <i>lonchophylla</i>	Range extension	(a)
<i>Asplenium viride</i>	Disjunction	(a)
<i>Draba cana</i>	Range extension	(a)
<i>Kalmia microphylla</i>	Disjunction	(d)
<i>Pellaea glabella</i> var. <i>occidentalis</i>	Disjunction	(a)
Northern extensions and disjunctions:		
<i>Arabis nuttallii</i>	Disjunction	(c)
<i>Carex praegracilis</i>	Range extension	(a)
<i>Eupatorium purpureum</i>	Rare, range extension	(e)
<i>Juncus confusus</i>	Range extension, disjunction	(d)
<i>Poa arida</i>	Range extension	(b)
<i>Salix amygdaloides</i>	Range extension	(e)
Southern extensions and disjunctions:		
<i>Gymnocarpium jessoense</i>	Rare, range extension	(a)
<i>Myrica gale</i>	Uncommon, range extension	(d, e)
<i>Polypodium virginianum</i>	Rare, range extension	(a)
<i>Selaginella rupestris</i>	Rare, range extension	(b)
Non-vascular plant species:		
<i>Amblystegium tenax</i>	Uncommon, northern limits of range	(e)
<i>Anomodon minor</i>	Rare, disjunction	(a)
<i>Myurella julacea</i>	Rare	(a)
<i>Neckera pennata</i>	Rare, southern range extension	(a)
<i>Rhodobryum ontariense</i>	Rare, northern range extension	(a)
<i>Timmia megapolitana</i>	Uncommon, eastern range extension	(a)

the Rockies. The additional sites at the Whitemud Falls Reserve represent range extensions for all of these species.

Arenaria capillaris, Sandwort, is a montane species with a range extending from eastern Asia to Alaska, Yukon, British Columbia and Alberta, south to Oregon, Nevada and Montana. In Alberta the plants, which are referable to var. *capillaris*, occur in the Rockies from Jasper south to Waterton Lakes National Park. The occurrence of the species in the Whitemud Falls region represents a significant disjunction in the Alberta range of this species.

Arnica lonchophylla, Spear-leaved Arnica, occurs from Alaska to British Columbia, and east to Saskatchewan, Manitoba and Ontario. In the west, the species extends its range south down the Rockies into Wyoming. A disjunct series of populations also occur in Quebec and Newfoundland. In Alberta, populations of this species occur primarily in the Rockies with a few records from the Wood Buffalo region in northeast Alberta. The recent discovery of

the site at the Whitemud Falls Reserve extends the range of the species to the northeast and adds a third locale in the province. In our region, the populations are referable to ssp. *lonchophylla*.

Asplenium viride, Green Spleenwort, has a circumboreal distribution and in North America occurs south to New York, Wisconsin, South Dakota, Colorado, Nevada, and Washington. In Alberta, the species is associated with calcareous rock cliffs and ledges in the Rocky Mountains. The site at Whitemud Falls Ecological Reserve establishes a significant disjunct.

Pellaea glabella var. *occidentalis*, Dwarf Cliff Brake, is distributed from Alberta and western North Dakota south to Colorado. In Alberta, it commonly occurs on calcareous rock cliffs and ledges in the Rocky Mountains; the site at the Whitemud Falls Reserve represents a major disjunction from the few known sites in the Alberta Rockies. It is notable that both *Asplenium viride* and *Pellaea glabella* occur only on calcareous bedrock outcrops within the Reserve.

Draba cana, Whitlow Grass, has a circumboreal distribution and in North America occurs as far south as Atlantic Canada, Ontario, northern Saskatchewan, Colorado, Utah, Nevada, Idaho, and British Columbia. In Alberta it had only been reported to occur in the Rocky Mountains from the foothills to the alpine zone. The new record from Whitemud Falls represents a significant eastward range extension in its Alberta distribution.

Kalmia microphylla, Small-leaved Mountain Laurel, occurs in montane meadows and bogs from the Yukon and the District of Mackenzie to California and Colorado. Its occurrence in the Whitemud Falls Reserve represents a disjunct population; it was previously known only from the Alberta Rockies and the Swan Hills in the west-central portion of the province.

(b) *Northern range extensions and disjunctions.*

Arabis nuttallii Robinson, *Eupatorium purpureum* L., *Poa arida* Vasey, *Carex praegracilis* Boott., *Juncus confusus* Coville, and *Salix amygdaloides* Anderss. occur primarily in the southern regions of North America and have their northern-most limits of distribution in southern Canada. The sites at Whitemud Falls represent northern range extensions for these species in Alberta.

Arabis nuttallii, Nuttall's Arabis, occurs in the mountains of southern British Columbia and Alberta south to Washington, Nevada, Utah and Wyoming, on moist grassy flats to open ridges. This species was previously known only from a few sites within Waterton Lakes National Park.

Eupatorium purpureum, Spotted Joe-Pye Weed, occurs in moist woods from Newfoundland to North Carolina, west to southern British Columbia and New Mexico. Previously, only two collections of the species had been made in Alberta, one along the Peace River in north-central Alberta and one just west of Edmonton.

Two taxa that are frequent in southern Alberta, but previously rare or unknown from northern Alberta are *Poa arida* and *Carex praegracilis*. The Plains Bluegrass, *Poa arida*, is a prairie or salt marsh plant that is native to the Great Plains; the site at Whitemud Falls is a northern extension of the range for this prairie species. *Carex praegracilis*, the Graceful Sedge, occurs in moist prairie potholes and around saline basins from Manitoba to Alaska, south to Michigan, Minnesota, Texas and California. It is common in southern Alberta, but the locality in the Whitemud Falls region is only the second site for northern Alberta.

Juncus confusus, the Few-flowered Rush, is a prairie species that is distributed from southern Saskatchewan, Alberta, and British Columbia south to Colorado and California. The species is known from six sites in Alberta: four in and around Waterton (extreme southwestern Alberta), one site in the

Cypress Hills (southeastern Alberta), and one site in central Alberta near the Battle River. The site in the Whitemud Falls region is a significant disjunction.

Salix amygdaloides, the Peachleaf Willow, is associated with floodplains and pond and lake border habitats from southern Quebec and New York to southeastern British Columbia and Washington, south to Arizona, New Mexico, Texas, Kentucky, and Pennsylvania. It has been found in riparian habitats on the prairie in southeastern Alberta.

c) *Southern range extensions and disjunctions.*

Gymnocarpium jessoense (Koidz.) Koidz., *Polypodium virginianum* L., and *Selaginella rupestris* (L.) Spring, are vascular cryptogamic plants that are rare in Alberta (Packer and Bradley 1984). All three of these species are distributed across boreal Canada from the Yukon to Newfoundland and south into the eastern United States along the Appalachian and Ozark Mountain ranges. The few collections are mainly from the Peace/Athabasca River delta, in extreme northeastern Alberta, with one collection of *S. rupestris* in east-central Alberta near the Alberta-Saskatchewan border. The collections at Whitemud Falls represent slight southern range extensions.

Myrica gale L., Sweet Gale, ranges from Eurasia, Alaska and across boreal Canada to Newfoundland and south to the Great Lakes region and Appalachian Mountain Range in the eastern United States. Although not listed as rare in Alberta (Packer and Bradley 1984), it has only been reported at a few sites in the Peace/Athabasca River delta in extreme northern Alberta, and at one site further south near Fort McMurray. The collection at Whitemud Falls represents a minor southern range extension for the species.

3) *Rare and disjunct non-vascular plants.*

Six species of mosses (Bryopsida, Bryidae) that occur in the Whitemud Falls area can be considered as rare in the northeastern portion of Alberta. Like the rare vascular plants discussed above, the bryophytes have a mixture of ranges, extending into the study area from northwestern, eastern, or southeastern North America. The six species are *Amblystegium tenax* (Hedw.) C. Jens., *Anomodon minor* (Hedw.) Furnr., *Myurella julacea* (Schwaegr.) B.S.G., *Neckera pennata* Hedw., *Rhodobryum ontariense* (Kindb.) Kindb., and *Timmia megapolitana* subsp. *bavarica* (Hessl.) Brass.

Amblystegium tenax (= *Hygroamblystegium*) occurs on seasonally wet rocks along both calcareous and non-calcareous streams. It is circumboreal in distribution, and has been reported throughout Europe, North Africa, northern Asia, and Japan. In North America it has a primarily eastern range, being common from Newfoundland and Ontario south to Alabama and Arkansas (Crum and Anderson 1981). In the west it is rare, but reported from Texas,

Arizona, the Pacific Northwest, Nevada, Wyoming, Montana, and Utah. It is also known from a few collections in British Columbia. East of the Rockies, it has been collected from two localities in Saskatchewan (near Prince Albert and Amisk Lake), and from three localities in Alberta: one northeast of Fort McMurray, the second near Calgary, and the third at Cypress Hills. This is the second collection from northeastern Alberta, where it is at the northern edge of its range.

Anomodon minor was reported by Vitt and Lee (1984) from Whitemud Falls based on collections made by Peter Lee in 1983. This record represents a disjunction of about 1300 km from the nearest stations in extreme southern Manitoba. The North American range of this species was mapped by Vitt and Lee (1984) and extends from the Gaspé Peninsula west to the Winnipeg area, and south to Florida in the east, and Texas, New Mexico, and Arizona in the west. It is also disjunct in southern Mexico and Guatemala. It is a typical eastern North American deciduous forest species, occurring on the lower portions and bases of tree trunks, and on calcareous rock. The occurrence of this species at Whitemud Falls is a major disjunction, and represents an uncommon westward extension of an eastern species into the boreal forest of northern Alberta.

Myurella julacea is a montane-boreal species that is more common farther north and west. Although it is known from Alaska to Greenland, south to New England and Michigan in the east, and to Colorado and Oregon in the west, it is rare throughout central Canada due to lack of suitable habitats. The species occurs exclusively on calcareous substrates, usually in small crevices of cliff faces. It also occurs in calcareous arctic meadows, and boreal rich fens (Vitt et al. 1988). It is a typical species of montane rock outcrops throughout the Canadian Rockies.

Neckera pennata is a northern boreal species that reaches southward through the mountains in the west to Arizona, and in the east to North Carolina. It occurs across northern Canada, but becomes rare south of 60 degrees in the west. Although herbaria seem to contain quite a few collections of this species, many of them from the Canadian Rockies and other montane localities are misnamed. Specimens often are *Metaneckera menziesii* (Drumm.) Steere, a western North American endemic that, in Canada, does not occur east of the eastern slopes of the Rockies. We have examined specimens of *N. pennata* from the Yukon, mainland NWT, northwestern Saskatchewan, and extreme northeastern Alberta. This report is the southernmost station in the boreal forest, east of British Columbia and west of Ontario.

Rhodobryum ontariense is a species recently segregated from *R. roseum* (Iwatsuki and Koponen 1972). *Rhodobryum roseum* has a large distribution in Europe, extending eastward into middle Asia,

China, and Japan, with three localities in western North America (i.e.: near Aleza Lake, British Columbia, in the central Yukon, and on the Aleutian Islands). *Rhodobryum ontariense* is primarily an eastern North American — eastern Asian species. In North America, it is known from Newfoundland to Georgia in the east, westward to Oklahoma, South Dakota, Arizona and possibly Washington. In Alberta, it is one of our rarest mosses, known only from a station just north of Calgary, and several sites in and around Edmonton. The Whitemud Falls collection represents only the third area in the province. It has not been collected in Saskatchewan or in the Northwest Territories, and this report is the northwesternmost locality for the species in North America.

Timmia megapolitana, as a species, extends across boreal North America, Europe and Asia. It is represented by two subspecies (Brassard 1984). Subspecies *megapolitana* is a boreal-temperate taxon, known from Newfoundland, west to boreal Alberta, with a few collections reported from the Northwest and Yukon territories and Alaska. Subspecies *bavarica* is a montane-arctic taxon ranging from Greenland across the Arctic Islands to Alaska and the Yukon Territory, southward in the western mountains to Arizona and New Mexico. In boreal Canada, Brassard (1984) reported only two localities for subspecies *bavarica* east of the Rocky Mountain foothills; one on the west coast of Hudson Bay and one in east-central Saskatchewan. It was not previously known from boreal Alberta, and this report extends its known range considerably eastward at this latitude.

Conclusions

Whitemud Falls Ecological Reserve provides habitat for many rare and uncommon species, disjuncts and range extensions, especially considering its small size. Such a concentration of species is almost certainly related to the unusual suite of habitat conditions which occur within the Reserve. Of particular significance are habitats provided by: large limestone bedrock exposures (rock stacks) which are common within the Reserve but rare in Alberta east of the Rockies and foothills; small, spring-fed wetlands which are probably calcareous judging from springwater testing within the Reserve (Borneuf 1983) and which are relatively uncommon in northern Alberta; frequently flooded areas adjacent to the Clearwater River; and dry sand plains and dunes, which are local but uncommon in northern Alberta.

Limestone ledges and fissures provide substrates required by a few of the vascular cryptogams and most of the non-vascular species discussed above, and rapidly drained sands or calcareous wetlands provide suitable habitats for other vascular plants with similarly narrow requirements. Within the Reserve, however, many of the rare or disjunct vas-

cular species are not reported to occur exclusively in such restricted habitats elsewhere within their ranges. Possibly these species cannot compete within typical boreal mixedwood ecosystems (moderately moist, well drained, medium textured soils dominated by aspen) but can tolerate the less common, more extreme habitat conditions that are prevalent within the Reserve.

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