Downy ryegrass growing in Sheep River Provincial Park, Alberta. Creative Commons image by David.

# SUMMARY

This review summarizes the information that was available in the scientific literature as of 2021 on the biology, ecology, and effects of fire on downy ryegrass in North America.

Downy ryegrass is most common in boreal and subboreal regions, although its distribution extends as far south as the Black Hills. It occurs in montane, subalpine, and alpine elevations, growing in deciduous, coniferous, and mixedwood parklands, woodlands, and open forests. It sometimes dominates the understories of these communities. It also grows in shrubfields and grasslands.

Downy ryegrass is a rhizomatous perennial grass that is an important forage plant for some wildlife and livestock. It primarily regenerates from rhizomes, but it also regenerates from seeds and likely has at least a short-term soil-stored seedbank. It is most common on open sites; however, it may persist as the canopy closes. It tolerates soil disturbance and is often used in restoration projects.

Downy ryegrass likely responds to fire by sprouting from rhizomes and establishing from seed, although its methods of postfire regeneration were not noted in the literature. Downy ryegrass is often present in early postfire communities and may increase in abundance after fire. Many of the plant communities in which downy ryegrass occurs were historically maintained by frequent or moderate-interval fire, and frequent fire may help maintain plant communities with downy ryegrass.

**Citation:**
Fryer, Janet L. 2021. Leymus innovatus, downy ryegrass. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Missoula Fire Sciences Laboratory (Producer). Available: www.fs.fed.us/database/feis/plants/graminoid/leyinn/all.html.

# Table of Contents

# INTRODUCTION



## FEIS abbreviation:
LEYINN

## Common names:
downy ryegrass
boreal wildrye
downy rye grass
downy lyme-grass
downy wildrye
fuzzyspike wild rye
hairy wild rye
northern downy ryegrass
northwestern wild-rye
riverbank wildrye

TAXONOMY
The scientific name of downy ryegrass is *Leymus innovatus* (Beal) Pilg. (Poaceae) [7,32,35,43,48,53,106,115]. There are two subspecies:

*Leymus innovatus* subsp. *innovatus* [7,9,35,48,53] (downy ryegrass, typical subspecies)
*Leymus innovatus* subsp. *velutinus* (Bowdan) Tzvelev [7,9,35,53] (northern downy ryegrass)

**Hybrids:** Hybridization is common among the *Leymus* and *Elymus* genera [3,47]. Natural downy ryegrass hybrids include these named entities:

- ×*Agroelymus bowdenii* (Boivin) Barkw. (Bowden's agroelymus), from crossing with *Pascopyrum smithii* (western wheatgrass) [46,90,106]
- ×*Elyleymus hirtiflorus* (Hitchc.) Barkw. (Canadian wildrye), from crossing with *Elymus trachycaulus* (slender wheatgrass) [6,46,90,106]
- ×*Elyleymus turneri* (Lepage) Barkw. & Dewey (Turner wildrye), from crossing with *Elymus lanceolatus* subsp. *lanceolatus* (thickspike wheatgrass) [46,90,106]

and unnamed entities resulting from these crosses:

- *Elymus alaskanus* (Alaskan wheatgrass) × *Leymus innovatus* [90]
- *Leymus ambiguous* (Colorado wildrye) × *Leymus innovatus* [27]

Common names are used throughout this Species Review. For scientific names of plants and wildlife mentioned in this review and links to other FEIS Species Reviews, see table A1 and table A2.

## SYNONYMS
For ***Leymus innovatus***:
*Elymus innovatus* Beal [2,41,50]
*Elymus innovatus* (Beal) Pilg. [31,60]

For ***Leymus innovatus* subsp. *innovatus***:
*Elymus innovatus* Beal var. *glabratus* Bowden [50]

For ***Leymus innovatus* subsp. *velutinus***:
*Elymus innovatus* Beal var. *velutinus* Bowden [50]
*Leymus velutinus* (Bowden) A. Love & D. Love (documented in [106])

## LIFE FORM
Graminoid

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# DISTRIBUTION AND OCCURRENCE

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## GENERAL DISTRIBUTION

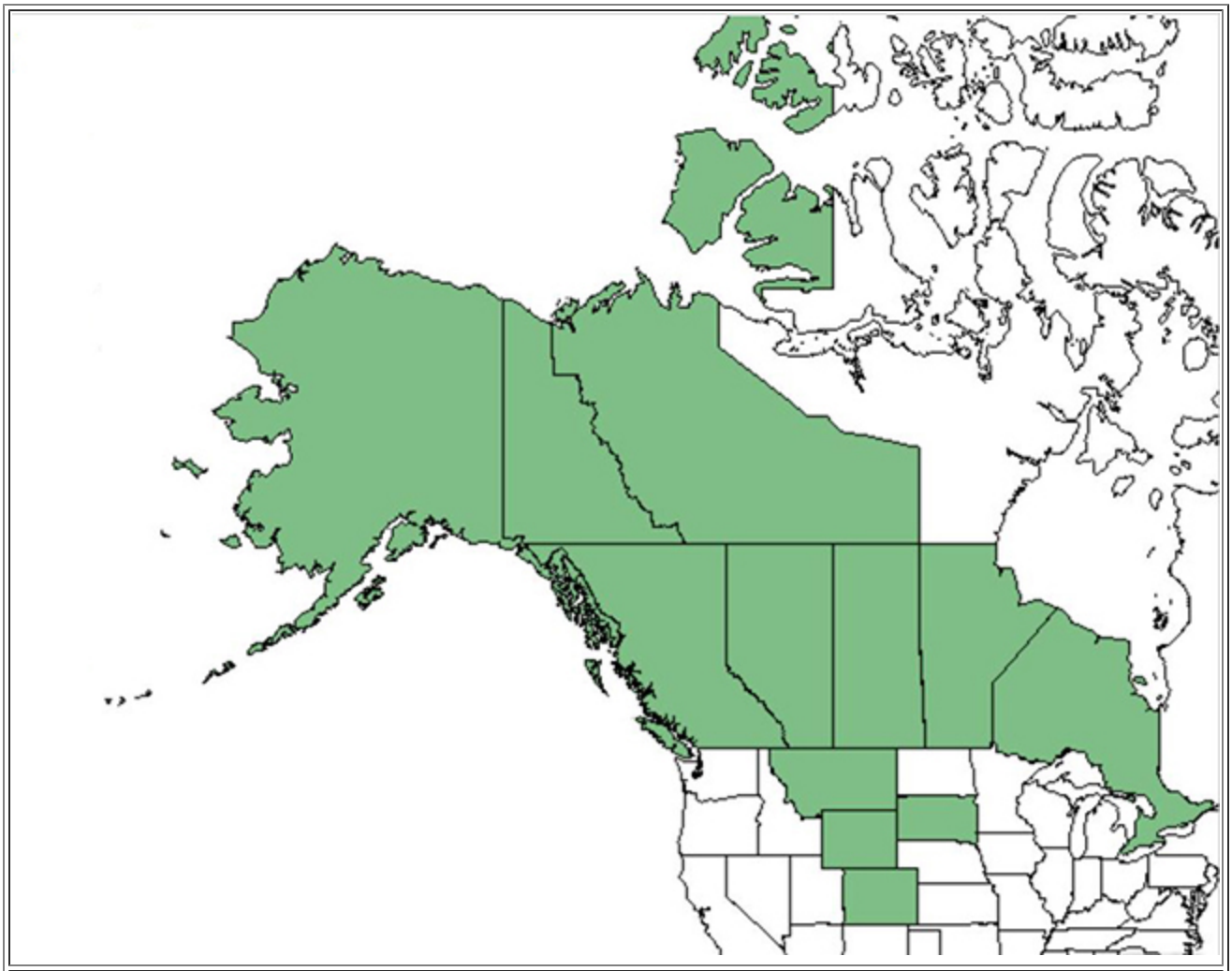

Figure 1—Distribution of downy ryegrass. Map courtesy of the U.S. Department of Agriculture, Natural Resources Conservation Service [106] [2021, February 21]. Downy ryegrass also occurs in Nunavut [38]. Its distribution in Colorado was unverified as of 2021 [52].

Downy ryegrass is distributed from northern Alaska east to Nunavut and Ontario and south to Wyoming [41,52] (fig. 1). It is rare in Saskatchewan and Montana and adventive in northeastern Wyoming and northwestern South Dakota [52].

The typical subspecies' distribution overlays that of the species (fig. 1) [52]. Populations of the typical subspecies in the Black Hills are disjunct from more continuous populations farther north [9]. Northern downy wildrye is the rarer of the two subspecies [7,9]. It occurs in Alaska, Yukon, the Northwest Territories [7,9,52], and Nunavut. It has been collected as far north as Banks Island, Nunavut, in the Canadian Arctic Archipelago [38].

States and provinces:
United States: AK, MT, SD, WY [106]
Canada: AB, BC, MB, NT, NU, ON, SK, YT [83,106]

## SITE CHARACTERISTICS

Downy ryegrass occurs in temperate montane [13,20,89,102], subboreal, boreal [18], and arctic [38] regions. Its cover is generally highest in boreal latitudes [102]. Downy ryegrass is winter hardy [51,55] and drought resistant [51].

Soil moisture on sites with downy ryegrass ranges from wet [20,75] to dry [20,59,83,84]. Downy ryegrass is most common in mesic to dry soils [20,89], but it also grows near stream- and riverbanks [7,8,30,31,47,48,60]. In foothill lodgepole pine forests of western Alberta, downy ryegrass is common to dominant in mesic to dry soils, while bluejoint is common to dominant in moist to mesic soils [21]. Downy ryegrass is considered an indicator species for very dry to dry white spruce forests of Saskatchewan and Manitoba [84]. However, it is listed as a possible wetland species in Alaska [82]. In the western United States, downy ryegrass is most common in moist to mesic subalpine forests [75].

Downy ryegrass grows in moderately poor to nutrient-rich soils [20,83] and in both alkaline [7] and acidic [51,96] soils. Near Slave Lake in boreal Alberta, white spruce-quaking aspen/downy ryegrass forests occupy mesic, medium-nutrient, acidic tills [58].

Downy ryegrass grows in soils of all textures [69]—including rocky to gravelly [7,47,48,83], sandy [7,8,48,50,83], and silty [7,8,48] soils—and in unconsolidated substrates including rapidly to moderately drained till [20,58,69,84] and colluvium [20,69,83]. In Manitoba, downy ryegrass is “widespread” on driftline soils and on sandy lakeshores, including upper beaches of Lake Manitoba [94].

Downy ryegrass often grows in calcareous substrates [18,67,83]. For example, it grows in limestone-derived soils in the south Brooks Range of Alaska [18] and the Black Hills [67]. It grows in calcareous and shale-derived soils in boreal Canada [83].

Downy ryegrass grows in montane, subalpine, and alpine elevations, depending on latitude and site (table 1).

Table 1—Elevation of downy ryegrass by area.

| Area | Elevational range (m) |
|---|---|
| Alaska | |
| subarctic and boreal interior | ≤1,400 [19] |
| Denali National Park | ≤1,400 [50] |
| Montana | 1,380-1,530 [29] |
| Alberta | |
| Rocky Mountains, timberline meadows | 2,060-2,200 [4] |
| Banff and Jasper national parks | most common below 1,300 [59] |
| British Columbia | 1,000-1,680 [13,91] |

Downy ryegrass occurs on flat to steep slopes [17,22,47]; it is most common on south-facing exposures in subboreal and boreal sites [4,13,20]. On the Mackenzie River Delta and Reindeer Grazing Preserve, Yukon, downy ryegrass occurs on steep, eroding upper and middle slopes of the Caribou Hills and the east side of the Anderson River [17].

## PLANT COMMUNITIES

Downy ryegrass grows in deciduous, coniferous, and mixedwood parklands, woodlands, and open forests [7,30,31,47,48,60,72]; shrubfields [44]; tundra; boreal, subboreal, and alpine grasslands [86]; montane meadows [2,114]; and Palouse [48] and northern mixedgrass [7,30,31,47,48,60,72,74] prairies. Although downy ryegrass is often dominant in subboreal and boreal communities, the surface layer vegetation in such communities is often sparse, with downy ryegrass cover typically averaging <5% [80,81]. In quaking aspen communities of northern and central Alberta, for example, downy ryegrass was the most consistently occurring graminoid in the surface layer (75% frequency), but it averaged only 4.8% cover [102]. Further details of the plant communities in which downy ryegrass grows are described below by area. See table A3 for a representative list of plant classifications in which downy ryegrass occurs.

**Alaska:** In Alaska, downy ryegrass occurs in the understory of conifer and hardwood communities—particularly spruce and quaking aspen [22]—and in shrubland and herbaceous communities. It occurs in tundra of the Arctic Slope [97,114]. It may dominate dry herbaceous communities on slopes of interior Alaska, and it forms small, localized stands on floodplains and dry, south-facing slopes of the Alaska and Brooks ranges [19,110]. Downy ryegrass-Altai fescue/splendid feather moss and downy ryegrass-plains bluegrass are the prevailing communities of this type, although downy ryegrass sometimes grows in pure stands [110,114].

**Western United States:** Downy ryegrass grows in inland ponderosa pine, Douglas-fir [5,73], and lodgepole pine communities [41]; Palouse prairies [48] east of the Cascade Range [32]; and mixedgrass prairies of the Northern Great Plains [41,74]. It is frequent in paper birch-quaking aspen and Scouler's willow woodlands in the Black Hills [67,108]; these are most common on south-facing slopes [67]. It also grows in ponderosa pine [54,108] and white spruce/grouse whortleberry communities in the Black Hills, averaging 13% frequency in each [65].

**Canada:** In subboreal and boreal communities of western Canada, downy ryegrass grows in conifer, hardwood, and mixedwood communities; and in meadows and prairies [69,83]. In eastern Canada, it grows in open jack pine, white spruce-balsam fir, and quaking aspen forests [83].

**Alberta:** Downy ryegrass may dominate the surface layer of old-growth Douglas-fir, lodgepole pine [20,49,59,78,105], and Engelmann spruce-subalpine fir forests; and of montane white spruce parklands [105]. In Jasper National Park, cover of downy ryegrass ranged from 5% to 20% in 100- to 300-year-old Douglas-fir/downy ryegrass vegetation types [49]. Cover of downy ryegrass in 100- to 225-year-old Engelmann spruce types ranged from 1% to 15%; even at that low cover, it was the dominant grass. In lodgepole pine/russet buffaloberry/showy western aster-downy ryegrass/splendid feather moss vegetation types, showy western aster and downy ryegrass provided 10% to 20% cover each [49].

Downy ryegrass is characteristic and may be dominant in quaking aspen communities [72,104] on south- [20] and west-facing [49] slopes. In Banff and Jasper national parks, it is usually dominant in quaking aspen communities [49]. Graminoids typically have low cover in quaking aspen stands, averaging about 3%; however, downy ryegrass is among the "most prominent" of those present [104].

Downy ryegrass is present to dominant in willow, resin birch, and kinnikinnick shrublands of Alberta [13,49]. For example, it forms 2% to 40% cover in greyleaf willow and resin birch-greyleaf willow/Bellardi bog sedge communities [13].

Downy ryegrass occurs in and may dominate subalpine and Northern Plains grasslands [104,113]. In mixedgrass prairies, it is sometimes codominant or subdominant in bluebunch wheatgrass, slender wheatgrass, and thickspike wheatgrass communities [113].

# BOTANICAL AND ECOLOGICAL CHARACTERISTICS



Figure 2—Downy ryegrass in Fort Smith, Northwest Territories. Creative Commons image by M. Torre Jorgenson.

## BOTANICAL DESCRIPTION

This description covers characteristics that may be relevant to fire ecology and is not meant for identification. Identification keys are available (e.g., [8,14,43,115]).

Downy ryegrass is a perennial grass. It is typically rhizomatous [2,41,43,50,60] and sod forming [83], but it sometimes forms clumps or tussocks [8,28]. Plants range from 10 to 160 cm tall [8,50,83]; plants 30 to 70 cm tall are reported in interior Alaska [110]. The leaves are rigid, coarse, and flat to spirally curled [83]. The inflorescence is a compact spike [35] from 6 to 14 cm long [60]. Downy ryegrass flowers characteristically have tall (10-15 mm), dense spikelets [2,47,83], pubescent lemmas, short (1-6 mm) awns [7,41,43,47,50,60], and densely hairy glumes [7,83] (fig. 2). Seeds range from 9.9 to 14.3 mm long [15]. The subspecies are distinguished from each other by the lengths of their spikes and lemma hairs [7]. Rhizomes are 2 to 3 mm in diameter [41].

### Raunkiaer Life Form

Geophyte [79]

## SEASONAL DEVELOPMENT

Hunt and Wright (2007) state that downy ryegrass "germinates best in cool soils" [51], suggesting fall or early spring germination. Downy ryegrass flowers in summer [53] (table 2).

Table 2—Phenology of downy ryegrass by area.

| Area | Event |
|---|---|
| Great Plains | flowers June-July [41] |
| Montana | flowering peaks June-July, extends to September [96] |
| Canada<br>boreal and subboreal<br>Alberta | <br>flowers June-July; seeds ripen late July-September [83]<br>greenup March-April [96] |

## REGENERATION PROCESSES

Downy ryegrass primarily reproduces vegetatively from rhizomes and from seed.



### Vegetative Reproduction and Regeneration

Downy ryegrass spreads by sprouting from rhizomes [2,83,96,111] and by tillering [83]. In restoration projects in and near Denali National Park, downy ryegrass rhizomes were "vigorous and spreading" [26]. Downy ryegrass likely regenerates from rhizomes after top-kill, although information on this was lacking.

### Pollination and Breeding System

*Leymus* species are wind pollinated [36,76,96]. It is self-incompatible, requiring cross-pollination [7,28,76].

### Seed Production

No information was available on this topic.

### Seed Dispersal

No information was available on this topic. Seeds are likely dispersed by wind and animals.

### Seed Banking

Downy ryegrass likely has at least a short-term soil-stored seed bank. In quaking aspen stands in northern Alberta, downy ryegrass seedlings emerged from soil collected from the organic horizon and from mineral layers at 2.5- to 10-cm depths. Aboveground cover of downy ryegrass ranged from trace amounts to 5.4% [64]. The longevity of soil-stored seed is unknown [15].

### Germination and Seedling Establishment

Downy ryegrass seed apparently has no pregermination requirements [51], although germination rates may be low. Seed collected from Denali National Park had "poor" germination rates [25]. Stratified seed from interior British Columbia averaged 32% germination (range 12%-50%) [15].

Seeds may germinate and plants establish in mineral soil or litter [26,111]. In outwash of the Muldrow Glacier in central Alaska, downy ryegrass established in bare gravel and decaying clumps of Drummond's mountain-avens and

smallflowered milkvetch [111].

### Plant Growth and Mortality

No information was available on this topic.

## SUCCESSIONAL STATUS

Downy ryegrass is somewhat shade intolerant and most common on open sites, including clearings, parklands, woodlands, and forest openings [7,8,39,83]. In forest communities, it is most common in early-seral stages and generally declines with canopy closure [51]. It may spread rapidly on disturbed sites via rhizomes [96]. It is common in early postfire communities [39,40,62] and clearcuts [100]. In boreal forests of northern Alberta, downy ryegrass was most common in gaps, then in white spruce parklands. It was least common in mature (40%-60% overstory cover) mixedwood forests [109].

Downy ryegrass tolerates soil disturbance [12,42,44,60,77,85,103] and may grow on sites that were recently salvage logged [57,63] (see Fire Adaptations and Plant Response to Fire) or bulldozed [103]. In northeastern British Columbia, downy ryegrass was associated with quaking aspen sites with heavily compacted soils lacking an organic layer [42]. Ten years after treatments in a white spruce plantation, downy ryegrass and bluejoint dominated the surface layers of sites that were clearcut, then subject to brush removal and glyphosate spraying, while bluejoint and fireweed dominated sites that were only clearcut [12].

Downy ryegrass occurs in primary and early secondary succession in subboreal and boreal sites, including scoured avalanche chutes [19,44,85] and floodplains [111], and bare glacial till [111]. Downy ryegrass-obtuse sedge meadows form on avalanche chutes in Alaska [19]. On outwashes of the Muldrow Glacier in central Alaska, downy ryegrass averaged 67% frequency in 20- to 30-year-old downy ryegrass-Altai fescue meadows [111]. On floodplains in the Alaska Range, downy ryegrass grasslands may develop after pioneering perennial-herb communities; this development apparently occurs within a few decades if the sites are not further disturbed [111]. Downy ryegrass grasslands on steep slopes are often stable, and they may represent microclimatic, topographic, or edaphic climaxes [110].

In conifer and hardwood communities, downy ryegrass may persist—or even remain as a sparse but dominant component of the surface layer—as the canopy closes [5,62,69,101]. Downy ryegrass is noted as a component of mature and old-growth conifer communities of Alberta, where it occurs in Douglas-fir/common juniper (100 to >300 years old), lodgepole pine/thickspike wheatgrass (125 to >290 years old), and Engelmann spruce-subalpine fir/russet buffaloberry (125 to >260 years old) forests, and montane white spruce parklands (≈128 to 300 years old) [105].

Frequent fire and/or logging help maintain the open conditions that favor downy ryegrass. In the Black Hills, downy ryegrass occurs in paper birch-quaking aspen woodlands that succeed to lodgepole pine. Fire historically set back succession in these woodlands [67]. For example, fire maintains quaking aspen/squashberry/dwarf red blackberry communities of west-central Alberta, in which downy ryegrass is an important component. These communities succeed to white spruce in 100 to 150 years in the absence of fire [20]. In southern Alberta, downy ryegrass is an important component of quaking aspen stands that succeed to subalpine fir-Engelmann spruce in the absence of fire, and it may remain dominant as succession advances. Even when dominant in the surface layer of these woodlands and forests, downy ryegrass cover is usually low (<5%) [4].

Clearcutting can favor downy ryegrass; no studies of downy ryegrass abundance after thinning were found in the literature. In western Alberta, downy ryegrass cover was positively correlated with clearcuts and young lodgepole pine stands ($r = 0.80$, $n = 25$). Its cover averaged 7.7% in 6- to 7-year-old stands and 1.5% in 130-year-old stands. After fireweed, downy ryegrass was the second most common herb in early-seral communities [21]. Also in western Alberta, downy ryegrass cover was higher in 35-year-old clearcuts (0.08%) than 1-year-old clearcuts (0.01%) [112].

Downy ryegrass may increase in abundance on rangelands due to its relative unpalatability. In Banff and Jasper national parks, it is a frequent associate in Kentucky bluegrass communities that have been heavily grazed by horses [99].

# FIRE ECOLOGY AND MANAGEMENT



## IMMEDIATE FIRE EFFECTS

No information was available on this topic as of 2021. Fire probably top-kills downy ryegrass.

### Possible Postfire Regeneration Strategies

Rhizomatous grass, rhizome in soil
Tussock graminoid
Herbaceous root crown, growing points in soil
Geophyte, growing points deep in soil
Ground residual colonizer (on site, initial community)
Initial off-site colonizer (off site, initial community)
Secondary colonizer (on- or off-site seed sources) [98]

## FIRE ADAPTATIONS AND PLANT RESPONSE TO FIRE

Downy ryegrass likely responds to fire by sprouting from rhizomes and establishing from seed, although its methods of postfire regeneration and response to fires of various severities were not noted in the literature. Sprouting is probably its most important method of postfire regeneration. Downy ryegrass is often present in early postfire communities [39,40,54,61,62,91], including jack pine [68,89], white spruce [34,91], subalpine fir-Engelmann spruce [34], lodgepole pine [1,73], quaking aspen [61], balsam poplar [91], and mixedwood [57] woodlands and forests; shrublands [73,87]; and meadows and prairies [44,45,87,92]. Its cover may increase after fire [87,89].

In white spruce and subalpine fir-Engelmann spruce forests of Banff and Jasper national parks, downy ryegrass is common in early postfire succession [34,73,87]. In Jasper National Park, its postfire cover in mesic white spruce communities was highest in postfire years 0 to 10, stable in postfire years 10 to 60, and lowest in 100- to 300-year-old forests [73]. Also in Banff National Park, downy ryegrass was the dominant grass—and the second most dominant herb after fireweed—on sites that had been recently burned under prescription. Its cover was higher in recently burned communities than in mature communities, and its cover was highest after prescribed fire in mature subalpine fir-Engelmann spruce communities (table 3). The authors did not age the mature forest communities, but they speculated that they were at least 50 years old [87].

Table 3—Downy ryegrass cover in mature and recently burned communities in Banff National Park [87].

| Plant community | Downy ryegrass cover (%) | |
|---|---|---|
| | Mature | Recently burned (mean time since fire) |
| lodgepole pine/kinnikinnick | 2 | 6 (10) |
| lodgepole pine/russet buffaloberry | 2 | 3 (7) |
| subalpine fir-Engelmann spruce/feather moss | 2 | 10 (7) |
| kinnikinnick/downy ryegrass | 4 | 5 (8) |
| shrubby cinquefoil/wheatgrass | 1 | 2 (4) |
| willow-bog birch | 3 | 4 (3), 3(8) |

In jack pine forests, downy ryegrass abundance may increase after fire and be more important in forests that were not salvaged logged than in forests that were salvaged logged. Schwartz and Wein (1992) report that downy ryegrass "occurs widely in the understory of jack pine and increases cover dramatically after fire" [89]. In northeastern Alberta, downy ryegrass had a high importance value and was an indicator species of unsalvaged jack pine forests that had burned 2 years prior, in the 2002 House River wildfire. It had lower importance values in burned, salvaged-logged jack pine-black spruce and mixed conifer-quaking aspen forests [63].

Downy ryegrass can occur after fire in white spruce-quaking aspen forests. In a white spruce-quaking aspen forest north-central Alberta, it occurred on plots both before and after the 2001 Chisholm wildfire, although its abundance was not provided [62]. In northern Alberta, downy ryegrass was abundant in and an indicator species of boreal white spruce-quaking aspen sites that had been salvage logged in the first few years after wildfire [57] (table 4).

Table 4—Downy ryegrass abundance in burned boreal mixedwoods of Alberta, without and with salvage logging [57].

| Site | Posttreatment year 2-3 | Posttreatment year 33-34 |
|---|---|---|
| Wildfire only | 1.63% cover, 76% frequency | 10% frequency |
| Wildfire and salvage logged | 5.32% cover, 82% frequency | 3% frequency |

Fire may help maintain downy ryegrass presence in shrublands, meadows, and prairies. In Jasper National Park, downy ryegrass cover in xeric to subxeric common juniper-russet buffaloberry shrublands was considered "stable" in postfire years 0 to 10, 10 to 20, and 20 to 60; but its cover declined in shrublands that had not burned for 80 to 250 years [73]. In Banff National Park, willow/downy ryegrass shrubfields, russet buffaloberry/downy ryegrass shrubfields, and downy ryegrass-Pumpelly's brome-Altai fescue meadows are maintained by fire, grazing, and/or avalanche activity; forming a mosaic with hybrid spruce (white spruce × Engelmann spruce) and lodgepole pine communities [44,45]. In northeastern British Columbia, downy ryegrass dominates subalpine meadows that form a mosaic with lodgepole pine, quaking aspen-balsam poplar, and mixed woodlands. The meadows are maintained by frequent fire. Downy ryegrass had 48% frequency in recently burned sites and 10% frequency in older clearings and mixed woodlands [92].

## FUEL CHARACTERISTICS

Information on downy ryegrass fuels was sparse in the literature. Although it is often dominant in boreal and subboreal woodlands and forests, downy ryegrass cover is typically low in these communities (see Plant Communities), so downy ryegrass may not provide substantial surface fuels. In pink mountainheath-white arctic mountain heather alpine shrublands of southwestern British Columbia, dry weight biomass of downy ryegrass averaged 243 g/m² from 1,554 to 1,570 m elevation and 84 g/m² from 1,623 to 1,676 m elevation [13]. The root crowns of downy ryegrass are enveloped by old leaf sheaths [41], which may increase its flammability.

## FIRE REGIMES

Many of the plant communities in which downy ryegrass occurs were historically maintained by frequent or moderate-interval fire, and downy ryegrass tends to occur on early-successional and open sites (see Successional Status). In Jasper National Park, large, old Douglas-firs with thick bark and multiple fire scars indicate that fires were a common occurrence in Douglas-fir/downy ryegrass woodlands and forests [49]. The lodgepole pine/russet buffaloberry/western showy aster-downy ryegrass/splendid feather moss types of Jasper National Park are mostly 60 to 100 years old and of fire origin [49].

See these FEIS publications for information on historical fire regimes in plant communities in which downy ryegrass is dominant or common:

- Alaskan black spruce
- Alaskan white spruce
- Alaskan black cottonwood
- Alaskan quaking aspen and balsam poplar
- Alaskan alder and willow shrublands
- Alaskan tundra
- Alaskan dry grassland
- Alaskan wet and mesic herbaceous systems
- Aspen-birch
- Jack pine
- Rocky Mountain Douglas-fir
- Rocky Mountain lodgepole pine
- Northwestern montane and foothill grasslands
- Rocky Mountain subalpine mixed conifer
- Rocky Mountain subalpine shrublands
- Northern Rocky Mountain montane shrublands
- Northern Rocky Mountain high-elevation grasslands
- Western alpine
- Black Hills ponderosa pine
- Plains grassland and prairie

### FIRE MANAGEMENT CONSIDERATIONS

Frequent fire may help maintain plant communities with downy ryegrass, and downy ryegrass would likely benefit from prescribed fires that maintain open plant communities (see Successional Status and Fire Adaptations and Plant Response to Fire). Downy ryegrass apparently tolerates postfire logging.

Prescribed fire and wildfires for resource benefit have been used to maintain or increase downy ryegrass abundance for wildlife habitat and forage (see Importance to Wildlife and Livestock). In northern British Columbia, prescribed burning is conducted on ≈1-ha areas within white spruce and balsam poplar woodlands to promote or create downy ryegrass meadows, which provide winter and spring habitat and forage for Dall's sheep [91,93]. Prescribed fire has been used in Jasper National Park to increase cover of downy ryegrass and other herbs for elk forage [87]. Near Anchorage, Alaska, downy ryegrass was a component in the winter diets of woodland bison in bluejoint-downy ryegrass meadows that had burned in a wildfire 4 years prior [16].

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## OTHER MANAGEMENT CONSIDERATIONS

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- **FEDERAL LEGAL STATUS**
- **OTHER STATUS**
- **IMPORTANCE TO WILDLIFE AND LIVESTOCK**
- **VALUE FOR RESTORATION OF DISTURBED SITES**
- **OTHER USES**
- **MANAGEMENT UNDER CLIMATE CHANGE**

### FEDERAL LEGAL STATUS

None [107]

### OTHER STATUS

NatureServe (2021) ranks downy ryegrass as Imperiled (S2) in Montana and Wyoming, but Secure (S5) elsewhere [74]. Altai fescue-downy ryegrass prairies are classified as rare and imperiled (S2) in Montana [74,85] and Wyoming [74]. Information on state- and province-level protection status of plants in the United States and Canada is also

available in Plants Database.

## IMPORTANCE TO WILDLIFE AND LIVESTOCK

Downy ryegrass provides forage for wildlife and livestock [7,13,66], including bighorn sheep [13,34], Dall's sheep [91,93], elk [1,39,70,87,112], moose [39,40], mountain goats [10,34], mule deer, woodland caribou [23], woodland bison [16], cattle, domestic sheep [13], and horses [13,88,99]. Grizzly bears habituate and apparently prefer willow/downy ryegrass and russet buffaloberry/downy ryegrass habitat types for foraging [44,45].

Several studies document the importance of downy ryegrass in the diet of wildlife. In northern British Columbia, elk preferentially chose recently burned downy ryegrass meadows as foraging habitat [39]. In another study in the area, downy ryegrass was the only grass preferentially selected by woodland caribou [23]. In northern Alberta, downy ryegrass may be a major forage plant for woodland bison [81]. In Banff National Park, downy ryegrass-Kentucky bluegrass and downy ryegrass alluvial meadows interspersed within white spruce forests provide winter and migration forage for elk [71]. In western Alberta, downy ryegrass was an important year-round component in the diet of feral horses, and the primary component in their diet from January through August [88].

### Palatability and Nutritional Value

Downy ryegrass is not highly palatable [51,96]; its palatability is rated poor to fair for wildlife and livestock [29]. However, it is an important forage grass [51,96] due to its relative frequency (see Plant Communities) and cold tolerance [51].

Downy ryegrass contains moderate levels of protein. Bezeau (1962) provides information on the nutritional value of downy ryegrass [11].

### Cover Value

Downy ryegrass provides cover for birds and small mammals [51].

## VALUE FOR RESTORATION OF DISTURBED SITES

Downy ryegrass provides erosion control [96] and is used for restoration of disturbed subalpine, alpine, subboreal, and boreal areas [24,25,26,51,77], including high-elevation (1,525-2,070 m) [86] mine spoils [25,51,86] and steep grades. Laboratory tests suggest it may establish on oil spills [51,96].

When used in restoration projects, downy ryegrass can be established from seed [51] or container-grown plants [26], and it spreads well vegetatively [26,51]. Near Palmer, Alaska, survival of downy ryegrass seedlings averaged 96% after their first winter [55]. Seed may be commercially available [77,96]. A cultivar, 'Cantwell Germplasm downy wildrye', reportedly establishes well from seed and spreads rapidly via rhizomes [51]. Burton and Burton (2003) provide information for propagating downy ryegrass from seed [15].

## OTHER USES

Common wheat × downy ryegrass crosses have been developed to improve wheat production in the northern prairie provinces [76].

## MANAGEMENT UNDER CLIMATE CHANGE

No information was available on this topic.

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# APPENDIX

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| Table A1—Common and scientific names of plants mentioned in this review. Links go to FEIS Species Reviews. | |
|---|---|
| **Common name** | **Scientific name** |
| **Trees** | |
| balsam fir | *Abies balsamea* |
| black spruce | *Picea mariana* |
| Douglas-fir, Rocky Mountain | *Pseudotsuga menziesii* var. *glauca* |
| Engelmann spruce | *Picea engelmannii* |
| jack pine | *Pinus banksiana* |
| lodgepole pine, Rocky Mountain | *Pinus contorta* var. *latifolia* |
| paper birch | *Betula papyrifera* |
| ponderosa pine, Rocky Mountain | *Pinus ponderosa* var. *scopulorum* |
| quaking aspen | *Populus tremuloides* |
| Scouler's willow | *Salix scouleriana* |
| spruce | *Picea* spp. |
| white spruce | *Picea glauca* |
| **Shrubs** | |
| common juniper | *Juniperus communis* |
| dwarf red blackberry | *Rubus pubescens* |
| grayleaf willow | *Salix glauca* |
| grouse whortleberry | *Vaccinium scoparium* |
| kinnikinnick | *Arctostaphylos uva-ursi* |
| pink mountainheath | *Phyllodoce empetriformis* |
| resin birch | *Betula glandulosa* |
| russet buffaloberry | *Shepherdia canadensis* |
| shrubby cinquefoil | *Dasiphora fruticosa* subsp. *floribunda* |
| squashberry | *Viburnum edule* |
| white arctic mountain heather | *Cassiope tetragona* |
| willow | *Salix* spp. |
| **Forbs** | |
| Drummond's mountain-avens | *Dryas drummondii* |
| fireweed | *Chamerion angustifolium* |
| smallflowered milkvetch | *Astragalus nuttallianus* |
| western showy aster | *Eurybia conspicua* |
| **Graminoids** | |
| Altai fescue | *Festuca altaica* |
| Bellardi bog sedge | *Kobresia myosuroides* |
| bluebunch wheatgrass | *Pseudoroegneria spicata* |
| bluejoint | *Calamagrostis canadensis* |
| Bowden's agroelymus | *Agroelymus* × *bowdenii* |

| | |
|---|---|
| common wheat | *Triticum aestivum* |
| Pumpelly's brome | *Bromus inermis* subsp. *pumpellianus* |
| Canadian wildrye | *Elyleymus hirtiflorus* |
| Colorado wildrye | *Leymus ambiguous* |
| downy ryegrass | *Leymus innovatus*,<br>*Leymus innovatus* subsp. *innovatus* |
| northern downy ryegrass | *Leymus innovatus* subsp. *velutinus* |
| obtuse sedge | *Carex obtusata* |
| plains bluegrass | *Poa arida* |
| slender wheatgrass | *Elymus trachycaulus* |
| thickspike wheatgrass | *Elymus lanceolatus* subsp. *lanceolatus* |
| Turner wildrye | *Elyleymus* × *turneri* |
| western wheatgrass | *Pascopyrum smithii* |
| wheatgrass | *Elymus* spp. |
| wildrye | *Leymus* spp. |
| **Mosses** | |
| feather moss | *Hylocomium* spp. |
| splendid feather moss | *Hylocomium splendens* |

Table A2—Common and scientific names of wildlife species mentioned in this review. Links go to FEIS Species Reviews.

| **Common name** | **Scientific name** |
|---|---|
| bighorn sheep | *Ovis canadensis* |
| Dall's sheep | *Ovis dalli* |
| elk | *Cervus elaphus* |
| horse, feral | *Equus caballus* |
| grizzly bear | *Ursus arctos horribilis* |
| moose | *Alces americanus* |
| mountain goat | *Oreamnos americanus* |
| mule deer | *Odocoileus hemionus* |
| woodland caribou | *Rangifer tarandus caribou* |
| woodland bison | *Bos bison athabascae* |

Table A3—Representative plant community classifications in which downy ryegrass occurs.

| **FRES Ecosystems** |
|---|
| FRES 10 White-red-jack pine |
| FRES 19 Aspen-birch |
| FRES 18 Paper birch |
| FRES 20 Douglas-fir |
| FRES 21 Ponderosa pine |

| |
|---|
| FRES23 Fir-spruce |
| FRES26 Lodgepole pine |
| FRES 36 Mountain grasslands |
| FRES 37 Mountain meadows |
| FRES 38 Plains grasslands [37] |
| **Kuchler Plant Associations** |
| K012 Douglas-fir forest |
| K015 Western spruce-fir forest |
| K017 Black Hills pine |
| K063 Foothills prairie |
| K066 Wheatgrass-needlegrass |
| K095 Great Lakes pine forest [56] |
| **SAF Cover Types** |
| 1 Jack pine |
| 16 Aspen |
| 201 White spruce |
| 202 White spruce-paper birch |
| 203 Balsam poplar |
| 206 Engelmann spruce-subalpine fir |
| 210 Interior Douglas-fir |
| 218 Lodgepole pine |
| 237 Interior ponderosa pine |
| 251 White spruce-aspen |
| 253 Black spruce-white spruce |
| 254 Black spruce-paper birch [33] |
| **SRM (Rangeland) Cover Types** |
| 301 Bluebunch wheatgrass-blue grama |
| 303 Bluebunch wheatgrass-western wheatgrass |
| 311 Rough fescue-bluebunch wheatgrass |
| 313 Tufted hairgrass-sedge |
| 323 Shrubby cinquefoil-rough fescue |
| 409 Tall forb |
| 411 Aspen woodland |
| 610 Wheatgrass |
| 613 Fescue grassland |
| 902 Alpine herb |
| 905 Bluejoint reedgrass |
| 906 Broadleaf forest |
| 907 Dryas |
| 908 Fescue |
| |

| |
|---|
| 911 Lichen tundra |
| 912 Low scrub shrub birch-ericaceous |
| 916 Sedge-shrub tundra |
| 918 Tussock tundra |
| 920 White spruce-paper birch |
| 921 Willow [95] |

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