

# Index of Species Information

**SPECIES: Bromus inermis**

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## Introductory

**SPECIES: Bromus inermis**

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### **AUTHORSHIP AND CITATION :**

Howard, Janet L. 1996. Bromus inermis. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: <http://www.fs.fed.us/database/feis/> [2007, September 24].

### **ABBREVIATION :**

BROINE

### **SYNONYMS :**

NO-ENTRY

### **SCS PLANT CODE :**

BRIN2  
BRINI  
BRIND  
BRINI2

### **COMMON NAMES :**

smooth brome  
Austrian brome  
awnless brome  
bromegrass  
Hungarian brome  
Russian brome

### **TAXONOMY :**

The currently accepted scientific name of smooth brome is Bromus inermis Leyss. Infrataxa are [[54](#),[61](#),[68](#)]:

B. inermis ssp. inermis Leyss

B. inermis ssp. inermis var. divaricatus Rohlfs  
 B. inermis ssp. inermis var. inermis Leyss

Kartesz [68] recognizes Pumpelly brome as a subspecies of B. inermis, B. inermis ssp. pumpellianus (Scribn.) Wagnon. FEIS follows the treatment of other authorities in recognizing Pumpelly brome as a separate species, B. pumpellianus Scribn. [54,58,61,67,115,121]. (A literature summary of B. pumpellianus is available in FEIS.) Considerable hybridization and introgression have occurred between smooth brome, an introduced species, and Pumpelly brome, a native species [5,53,121]. Smooth brome does not hybridize with other North American species [4].

**LIFE FORM :**

Graminoid

**FEDERAL LEGAL STATUS :**

No special status

**OTHER STATUS :**

NO-ENTRY

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## DISTRIBUTION AND OCCURRENCE

### SPECIES: Bromus inermis

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**GENERAL DISTRIBUTION :**

Smooth brome is native to Eurasia. In North America it occurs from Alaska and all the Canadian provinces and territories south to southern California and New Mexico, northern Oklahoma, and North Carolina [6,61,67,90,99,110].

**ECOSYSTEMS :**

Smooth brome occurs in most FRES ecosystems.

**STATES :**

AK	CA	CO	CT	DE	HI	ID	IL	IN	IA
KY	KY	ME	MD	MA	MI	MN	MO	MT	NE
NV	NH	NJ	NM	NY	NC	ND	OH	OK	OR
PA	RI	TN	TX	UT	VT	WA	WV	WI	WY
DC	AB	BC	MB	NB	NF	NT	NS	ON	PE
PQ	SK	YT							

**BLM PHYSIOGRAPHIC REGIONS :**

- 1 Northern Pacific Border
- 2 Cascade Mountains
- 3 Southern Pacific Border
- 4 Sierra Mountains
- 5 Columbia Plateau
- 6 Upper Basin and Range
- 7 Lower Basin and Range
- 8 Northern Rocky Mountains
- 9 Middle Rocky Mountains
- 10 Wyoming Basin
- 11 Southern Rocky Mountains
- 12 Colorado Plateau

- 13 Rocky Mountain Piedmont
- 14 Great Plains
- 15 Black Hills Uplift
- 16 Upper Missouri Basin and Broken Lands

**KUCHLER PLANT ASSOCIATIONS :**

NO-ENTRY

**SAF COVER TYPES :**

Smooth brome occurs in most SAF Cover Types.

**SRM (RANGELAND) COVER TYPES :**

Smooth brome occurs in most SRM Cover Types.

**HABITAT TYPES AND PLANT COMMUNITIES :**

NO-ENTRY

**MANAGEMENT CONSIDERATIONS****SPECIES: Bromus inermis****IMPORTANCE TO LIVESTOCK AND WILDLIFE :**

Livestock: Smooth brome cultivars have been bred for nutritional quality and adaptation to selected climates. This has made smooth brome one of the most important exotic forage grasses in the United States and Canada. It is widely planted in pastures and rangelands from Texas to Alaska and Yukon Territory [[87](#),[88](#),[110](#)].

Wildlife: Grazing wildlife utilize smooth brome to varying degrees, depending upon wildlife species and smooth brome quality. Elk use it as a winter food [[63](#)]. Mule deer in central Utah were found to use it only lightly [[7](#)], but deer utilization of smooth brome is generally considered good [[40](#),[110](#)]. Geese [[26](#)] and small rodents such as pocket gophers [[81](#)] also graze smooth brome. The seeds may not be preferred by granivores. Everett and others [[46](#)] found that when offered the seed of 18 herbaceous species, deer mouse selected smooth brome seed the least.

Smooth brome provides cover for birds and small mammals [[10](#)]. Ducks, [[33](#),[78](#)], gray partridge [[27](#)], American bittern, northern harrier, and short-eared owl [[41](#)] use it as nesting cover.

**PALATABILITY :**

Early growth of smooth brome is highly palatable. Palatability and nutritional quality drop rapidly after flowering. Fall green-up provides palatable forage later in the year [[110](#)].

The palatability of smooth brome has been rated as follows [[40](#)]:

	UT	CO	WY	MT	ND
cattle	good	good	good	good	good

domestic sheep	good	good	good	good	good
horses	good	good	good	good	good

**NUTRITIONAL VALUE :**

The National Academy of Sciences [89] found the nutritional content of fresh, flowering smooth brome in the United States was as follows:

dry matter (%)	27.1
ash (%)	1.9
crude fiber (%)	8.3
ether extract (%)	0.9
N-free extract(%)	13.2
protein (% , N x 6.25)	2.8
digestible energy (Mcal/kg)	
cattle	0.79
domestic sheep	0.78

Nutritional content of fresh smooth brome in immature, early bloom, milk, dough, overripe, and weathered stages, and of cured smooth brome in each stage, is also available [89].

The nutritional value of smooth brome for wildlife has been rated as follows [40]:

	UT	CO	WY	MT	ND
elk	good	good	----	poor	----
mule deer	good	fair	----	----	poor
white-tailed deer	----	----	----	----	poor
upland game birds	good	----	----	----	poor
small nongame birds	fair	----	----	----	----
waterfowl	fair	----	----	fair	----
small mammals	good	good	----	----	----

**COVER VALUE :**

The cover value of smooth brome has been rated as follows [40]:

	UT	CO	WY	MT	ND
upland game birds	fair	----	----	good	good
waterfowl	fair	----	----	----	fair
small nongame burds	good	fair	----	fair	fair
small mammals	good	fair	----	good	----

**VALUE FOR REHABILITATION OF DISTURBED SITES :**

Smooth brome has been extensively used for rehabilitation. It is cold hardy and fairly resistant to saline soils and drought [117]. The ability of most cultivars to spread rhizomatously makes smooth brome a good soil binder [56,103,104]. It is recommended for erosion control and streambank and stream bottom stabilization in all areas of the United States except the Southeast [104,118]. Southern cultivars tend to be more strongly rhizomatous than northern cultivars, and generally give the best erosion control [64]. Some southern cultivars will grow in northern latitudes of the United States [25]. Smooth brome has also been successful in rehabilitating mined lands [38,43], game ranges [51,65], roadsides [42], and ski areas [12]. Smooth brome establishes on high-elevation sites [56]. It can be an aggressive colonizer on many sites, however, and may crowd out native species [107].

Smooth brome showed poor survivorship on semiarid canyonland in northwestern Idaho that was disked and seeded with several grass species to remove yellow starthistle (*Centaurea solstitialis*) [92].

**OTHER USES AND VALUES :**

NO-ENTRY

**OTHER MANAGEMENT CONSIDERATIONS :**

Range: Smooth brome's tolerance to grazing is generally rated as high [56]. It is highly adaptable, having persisted in many of the habitats where it was planted to increase forage production including pinyon-juniper (*Pinus-Juniperus* spp.) [39], quaking aspen (*Populus tremuloides*) [21], and subalpine and alpine ranges [56,102]. It has persisted on old saltgrass (*Distichlis spicata*) meadows with saline soils once the saltgrass was removed [84,85].

Smooth brome may not tolerate grazing on all habitat or site types. Currie and Smith [36] reported that smooth brome planted on low-fertility ponderosa pine (*Pinus ponderosa*) forest soils in Colorado declined under even light-intensity cattle grazing. They speculated that smooth brome is more likely to persist under cattle grazing on fertile soils.

Laycock and Conrad [77] used cattle to test several grazing systems on rangeland seeded to crested wheatgrasses (*Agropyron cristatum* and *A. desertorum*) and smooth brome in mountain big sagebrush (*Artemisia tridentata* spp. *vasyana*) habitat in Utah. They found that average cattle weight gain was the same under all systems, but heavy June grazing in alternate years best promoted grass production.

Ungulates in Yellowstone National Park utilized smooth brome growing in association with other graminoids and forbs, but did not graze smooth brome where it grew in a monoculture [48].

Forestry: In British Columbia, height and biomass of lodgepole pine (*Pinus contorta* var. *latifolia*) seedlings established from a mix of lodgepole pine seed and smooth brome and other grass seed were less than height and biomass of lodgepole pine seedlings established from lodgepole pine seed sown alone [28].

Native grassland restoration: Smooth brome dominates many native grasslands and old fields [2]. Masters and Vogel [82] stated that on tallgrass prairie, it is usually found in areas with a history of overgrazing and/or fire exclusion. Grassland restoration efforts often include controlling smooth brome with cool-season grass herbicides such as atrazine and glyphosate, mowing, and/or prescribed fire [73].

Anderson [2] found that near Lincoln, Nebraska, fall application of glyphosate helped control smooth brome. Atrazine may not be as effective; other studies [83,96] have reported that while atrazine controlled other exotic cool-season grasses, it did not significantly reduce smooth brome.

Establishment and maintenance: Seed handling and planting guidelines for smooth brome are available [49,116,117]. Cultivars adapted to selected environments and/or regions are sold commercially [56,103,104,108,119,123].

Smooth brome requires fertile soil in order to maintain nutritional quality. On infertile soils it needs periodic fertilization or a companion nitrogen fixer. On rangelands smooth brome is usually planted in a mix with alfalfa (*Medicago sativa*), yellow sweet clover (*Melilotus officinalis*), or other legume species. Fertilization affects growth allocation: Watkins [120] found that fertilizers increased leaf and shoot growth but reduced rhizome and root growth.

Rhizomatous cultivars become sod-bound after several years unless litter is removed by grazing and/or fire [56,110].

## BOTANICAL AND ECOLOGICAL CHARACTERISTICS

### SPECIES: *Bromus inermis*

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#### GENERAL BOTANICAL CHARACTERISTICS :

Smooth brome is an exotic, cool-season grass from 1.3 to 3.2 feet (0.4-1.0 m) tall. Blades are flat. The inflorescence is an open panicle from 2.4 to 6.8 inches (6-17 cm) long bearing 6 to 11-flowered spikelets. Lemmas have short awns (<2 mm) or are unawned [53,54,61].

Two principle types of smooth brome are recognized, the northern and southern. The northern type is weakly rhizomatous, with leaves well up on the stem and short glumes. A few northern cultivars are actually bunchgrasses. The southern type is strongly rhizomatous, with leaves near the base of the stem and long glumes. Other notable differences are earlier spring growth of the southern type and more even growth of the northern type through the growing season [55].

In a meadow in West Virginia on shallow silty loam, smooth brome roots grew to a depth of 18 inches (46 cm), with most of the root biomass occurring in the first 3 inches (7.6) of soil. (Average root productivity was 717.7 lbs/acre inch at 0-3 inches below ground [52].) Witte [127] found roots as long as 9.4 feet (2.87 m).

Due to cloning, smooth brome is a long-lived species. Plantings have persisted for at least 60 years [98].

#### RAUNKIAER LIFE FORM :

hemicryptophyte

#### REGENERATION PROCESSES :

Smooth brome reproduces by seed, rhizomes, and tillers. Spread by seed has been rated moderate, and vegetative spread has been rated good [97].

Smooth brome is usually cross-pollinated [72,86], although it may self-fertilize from different spikelets of the same plant [86]. McKone [72] found that seed set was significantly lower in smooth brome than in other brome species. Insect herbivory has been cited as a factor reducing seed set in smooth brome [86,91]. Seed yield of smooth brome broadcast-planted in Michigan 174 pounds per acre when grown with alfalfa and 121 pounds per acre when grown alone [122]. Seed has remained viable for 22 months to over 14 years [49,55]. Seed stored in a shed for 19 years showed 20 percent germination [66]. Seed requires stratification to germinate. Germinative capacity of fresh, stratified seed has varied from 83 to above 95 percent in the laboratory [49]. Optimal temperatures for germination in the greenhouse were from 68 to 86 degrees Fahrenheit (20-30 deg C) [49]. Like all cool-season species, however, smooth brome can germinate at lower temperatures. Bleak [17] reported that smooth brome seed sown in late fall to early winter in central Utah germinated and produced roots and shoots under deep snow cover. Light enhances germination but is not required [49].

Seedling growth is rapid [56,59]. Knobloch [72], who described germination and seedling development in detail, reported that 54 days after sowing, greenhouse-grown seedlings had 150-millimeter-long roots, five leaves, and had begun tillering. Baker and Jung [9] found that under greenhouse conditions, the optimal day temperature for growth was between 64.9 and 76.8 degrees Fahrenheit (18.3-24.9 deg C), and that food reserves were depleted less with low night temperatures than with warm night temperatures. Cultivars differ in rate of growth and drought tolerance [30].

**SITE CHARACTERISTICS :**

Smooth brome is widely adapted to a variety of sites. It is common in riparian zones, valley bottoms, and dryland sites. [48,56,119]. It is adapted to all soil textures [49,55,90], although it may not thrive on sand or heavy clay [119]. Smooth brome tolerates acid soils; it comprised the dominant cover on a coal spoil of pH 4.5 in British Columbia [56]. It does not grow on soils that are more than moderately alkaline [55]. It is fairly saline tolerant [56]. Smooth brome grows best on moist, well-drained soils [49], but tolerates poorly drained soils [32]. Smooth brome is best adapted to regions receiving more than 15 inches (380 mm) of annual precipitation [98,119]. Eleven inches (280 mm) of annual precipitation is the minimum that will support smooth brome without irrigation [98].

Some cultivars of smooth brome are adapted to northern latitudes and high elevations [60,102]. Smooth brome persists to about 9,000 feet (2,743 m) elevation in the northern Rocky Mountains [24,119] and to about 11,000 feet (3,300 m) in the central and southern Rocky Mountains [119]. General elevational ranges in several states are:

from 7,000 to 10,000 feet (2,134-3,048 m) in Arizona [69]  
below 8,900 feet (2,700 m) in California [61]  
from 4,500 to 10,000 feet (1,372-3,048 m) in Colorado [57]  
from 4,096 to 10,352 feet (1,280-3,235 m) in Utah [121]

**SUCCESSIONAL STATUS :**

Smooth brome generally invades after disturbance and persists [19,20,37]. It is a common invader of disturbed prairie throughout the Great Plains [112,125,126]. In Yellowstone National Park, Wyoming, smooth brome cover was similar in young eastern cottonwood (*Populus deltoides*), mature eastern cottonwood, and grassland areas [19]. Boggs and Weaver [20] reported that along the Yellowstone River, moderate grazing increased the occurrence of shrubs in mature eastern cottonwood, and severe grazing converted the area to smooth brome, timothy (*Phleum pratense*), and Kentucky bluegrass (*Poa pratensis*).

Smooth brome tolerates moderate shade to full sun [49,56]

**SEASONAL DEVELOPMENT :**

Smooth brome undergoes fall green-up. Inflorescences are initiated during cool, short fall days [90]. In colder climates, smooth brome is dormant in winter. It may remain green year-round in southern climates [76]. Spring growth begins early in the season [110,107]. Lengthening culms expose the panicles in late spring to early summer [90], and smooth brome flowers in summer. In Minnesota, flowering occurred from early to late June [80,86]. It occurred in late May or early June in Ames, Iowa, with later, sporadic flowering [72]. Phenology is delayed in northern latitudes and high elevations. Smooth brome on the Wasatch Plateau of Utah flowers 85 to 102 days after snowmelt [44]. Seed matures in early to late summer [49]. Smooth brome grows throughout the growing season when soil water is adequate. Under dry soil conditions it becomes dormant, but it resumes growth when soils moisten [16].

**FIRE ECOLOGY**

**SPECIES: *Bromus inermis***

**FIRE ECOLOGY OR ADAPTATIONS :**

Most smooth brome cultivars are rhizomatous [[56,110](#)], and survive fire by sprouting from rhizomes. Weakly rhizomatous or bunchgrass types probably regenerate after fire primarily by tillering. Rates of postfire recovery probably differ between cultivars, with rhizomatous types recovering more quickly than bunchgrass types, but such differences have not been documented in the literature.

Periodic early spring or fall fire promotes rhizomatous smooth brome by removing litter from sod-bound plants [[56,110](#)].

**POSTFIRE REGENERATION STRATEGY :**

Rhizomatous herb, rhizome in soil  
Tussock graminoid

## FIRE EFFECTS

**SPECIES: *Bromus inermis***

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**IMMEDIATE FIRE EFFECT ON PLANT :**

Smooth brome is probably top-killed by fire.

**DISCUSSION AND QUALIFICATION OF FIRE EFFECT :**

NO-ENTRY

**PLANT RESPONSE TO FIRE :**

Early spring (late March-April) or late-season (late summer-fall) fire can increase smooth brome productivity [[62,65](#)], especially when smooth brome has become sod-bound. Late spring fire generally damages cool-season grasses such as smooth brome [[8,82](#)]. Old [[93](#)], Kirsch and Kruse [[71](#)], and Blankespoor [[15](#)] have reported reductions in smooth brome with late spring burning.

Old [[93](#)] attributed decreases in smooth brome after late April fire to the advanced stage of development of smooth brome. Rate of smooth brome regrowth after fire cannot always be predicted based solely upon season of burning and attendant phenological stage, however. Blankespoor and Larson [[16](#)] cited soil moisture and nutrient levels and soil texture as factors other than phenological stage that may affect smooth brome rate of recovery.

In order to determine at which stage of growth smooth brome is most susceptible to fire, Willson [[124](#)] prescribe-burned smooth brome at tiller emergence (late March at the Mead, Nebraska, study site), tiller elongation (mid-May), and heading (late May). Late March fire had no significant effect on smooth brome. Mid-May or late May fire reduced fall tiller density approximately 50 percent when compared to controls.

Examples of late spring fire: Short- and mid-grass prairie of Pipestone National Monument, Minnesota, was spring-burned (mid- to late April)

annually from 1983 to 1987. The prairie had been severely degraded by invasion of cool-season exotic grasses including smooth brome, quackgrass (*Elytrigia repens*), and Kentucky bluegrass. Fire severity was low to moderate except in 1984, when high fuel levels were present. Smooth brome postfire coverage was [11]:

	1984	1985	1987
season	spring	spring	summer
cover (%)	21.3	22.4	26.4(a)

a = data pooled with quackgrass

Lack of flower and seed production was noted in the cool-season grasses including smooth brome, while native warm-season grasses increased height growth and seed production. Height (cm) of smooth brome was as follows [11]:

Prefire		Postfire					
1983		1984		1985		1987	
spring	summer	spring	summer	spring	summer	spring	summer
60	50	60	60	50	40		

Smooth brome flowering was inhibited by a 2 May, 1972, prescribed fire in Minnesota prairie [95].

Examples of fire in seasons other than late spring: On the Rathbun Wildlife Area in southern Iowa, smooth brome is managed as ring-necked pheasant cover. Smooth brome showed a significant ( $P < 0.05$ ) increase in percent coverage following September or April prescribed burning. February burning resulted in a nonsignificant decrease in smooth brome coverage, with significant declines in smooth brome frequency in some years [51].

A 22 April, 1983, prescribed fire on the Hillendale Game Farm of central Pennsylvania increased smooth brome production. On 5 October, 1983, production was 69 kilograms per hectare on the unburned control and 612 kilograms per hectare on the burn [65].

In Iowa, three consecutive early spring (23-28 March, 1986; 11-12 April, 1987; 13-20 April, 1988) prescribed fires in pastureland excluded from grazing had no significant effect on smooth brome. On some plots, atrazine was applied 7 to 10 days after burning; the fire plus atrazine treatments had no significant effect on smooth brome [101].

#### DISCUSSION AND QUALIFICATION OF PLANT RESPONSE :

Late spring burning has sometimes been only marginally effective in controlling smooth brome [23,93]. Kirsh [70] reported that smooth brome was actually stimulated by an early May prescribed fire. This variable response may be due, in part, to the fact that control effects have been targeted against several cool-season exotic grasses rather than smooth brome alone. Since phenologies of cool-season grasses differ, timing of a particular fire may reduce other cool-season species but not smooth brome [16].

In a defoliation experiment, Harrison and Romo [58] found that smooth brome regrowth was related to both growth stage and soil moisture conditions. After defoliation in the vegetative stage, smooth brome resumed growth in 45 to 75 growing days when soil moisture was favorable. Smooth brome did not resume growth until the next growing season after clipping in dry years. When plants were defoliated during reproduction, new tillers did not emerge until the next fall regardless of soil moisture conditions.

Blankenspoor and Larson [16] used a prescribed fire and watering

treatment to determine smooth brome's response to late spring (9 May, 1989) fire under low and high soil moisture levels. They found the following changes in percent smooth brome biomass after treatment:

	Burned -----	Unburned -----
high-water	-17.0	+10.5
low-water	-8.2	+11.7

Decreases in the two burned treatments were significantly different ( $p=0.05$ ), but increases in the unburned treatments were not. Apparently when soil moisture is high, warm-season grasses are able to outcompete fire-injured smooth brome for water. With less soil moisture available, warm-season grasses may be less able to take competitive advantage of fire-injured smooth brome [16].

In the same study, Blankespoor and Larson [16] found that on unburned plots, increases in smooth brome biomass were greatest on plots with low initial smooth brome biomass. This relationship approached significance ( $p=0.06$ ) for unburned, high-water plots and was strongly significant ( $p=0.001$ ) for unburned, low-water plots. As a cool-season species with substantial growth occurring early in the growing season, smooth brome apparently encounters little competition from water-stressed, warm-season plants in the absence of fire.

#### **FIRE MANAGEMENT CONSIDERATIONS :**

If smooth brome is growing in association with a legume and an increase in smooth brome productivity is desired, early spring rather than late summer or early fall fire is generally recommended. Late-season fire harms many legume species [62,74,94].

Fire control: An important management goal in remnant prairie is to maintain or increase diversity of native species and depress growth and production of exotic invaders such as smooth brome. Becker [11] concluded that annual spring burning on Pipestone National Monument prairie helped control smooth brome and other cool-season exotic grasses, and that the structure, composition, and diversity of the severely degraded native prairie was improved by annual burning. Similarly, two consecutive spring fires on portions of an eastern South Dakota tallgrass prairie where smooth brome was dominant reduced smooth brome and Kentucky bluegrass coverage [15].

Blankespoor and Larson's [16] prescribed fire-water treatment study suggests that prescribed late spring fire will most effectively control smooth brome in wet years. They recommend continuing a program of prescribed burning through drier years, however. Since they found that smooth brome increased in importance without burning, and that increases were greatest when initial smooth brome biomass was low, they concluded that failing to burn smooth brome in dry years is likely to accelerate its expansion.

For control, Willson [124] recommended burning smooth brome in late spring after it has produced five or more green leaves per tiller; unelongated tillers, which are not greatly damaged by fire, generally have fewer than five green leaves per tiller.

Postfire plantings: Smooth brome has been extensively planted to increase forage and/or reduce erosion in burned areas [14,29,34,35,61,79,106]. This practice has been questioned because native species appear to be at least equally effective in reducing erosion, and exotic grasses such as smooth brome may interfere with the growth of native forbs and grasses [34].

Postfire plantings of smooth brome have been successful across a wide range of habitats and climates. For example, big sagebrush-threetip sagebrush (*Artemisia tridentata*-*A. tripartita*) rangeland in Idaho was burned in summer 1937 and seeded with one of six grasses to reduce

sagebrush cover and increase forage production. On plots seeded to smooth brome, smooth brome yield increased from 57 pounds per acre in 1940 to 148 pounds per acre in 1948. Sagebrush coverage was lower on smooth brome plots than on plots of any of the five other grasses planted [14].

In Montana smooth broome seeded in after stand-replacing fire in lodgepole pine (*Pinus contorta*) showed "fair" vigor (density of 4.4 plants/sq ft) on slopes with a southwestern exposure and "good" vigor (density of 8.2 plants/sq ft) on slopes with a northeastern exposure [45].

Litter accumulation: Bleak [18] reported a 39 percent average rate of decay of bagged smooth brome litter in direct contact with snow cover over two consecutive winters.

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### SPECIES: *Bromus inermis*

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