Species: Hesperostipa comata
From: Fire Effects Species Information Online Database (2/23/2011)

SPECIES: Hesperostipa comataIntroductory


INTRODUCTORY


AUTHORSHIP AND CITATION:

Zlatnik, Elena. 1999. Hesperostipa comata. 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/ [2011, February 23].

ABBREVIATION:

HESCOM
SYNONYMS:

Stipa comata Trin. & Rupr. [70,89,130]
NRCS PLANT CODE:

HECO26
HECOC8
HECOI

COMMON NAMES:

needle-and-thread grass

TAXONOMY:

The fully documented scientific name of needle-and-thread grass is Hesperostipa comata (Trin. & Rupr.) Barkworth (Poaceae) [79,129]. There are 2 recognized subspecies, H. c. ssp. comata, and H. c. ssp. intermedia (Scribner & Tweedy) Barkworth [79]. Some authors identify these infrataxa as varieties [36,80,87].
LIFE FORM:

Graminoid
FEDERAL LEGAL STATUS:

No special status

OTHER STATUS:

No entry

DISTRIBUTION AND OCCURRENCE
SPECIES: Hesperostipa comata

GENERAL DISTRIBUTION
ECOSYSTEMS
STATES
BLM PHYSIOGRAPHIC REGIONS
KUCHLER PLANT ASSOCIATIONS
SAF COVER TYPES
SRM (RANGELAND) COVER TYPES
HABITAT TYPES AND PLANT COMMUNITIES

GENERAL DISTRIBUTION:

Needle-and-thread grass grows throughout the western and midwestern United States and Canada, from the Yukon to California, east to Ontario, Indiana, and Texas, and south into Mexico. There are outlying populations in Rhode Island and New York [79,122].

ECOSYSTEMS:

| | |
|---|---|
| FRES20 | Douglas-fir |
| FRES21 | Ponderosa pine |
| FRES29 | Sagebrush |
| FRES30 | Desert shrub |
| FRES31 | Chaparral-mountain shrub |
| FRES35 | Pinyon-juniper |
| FRES36 | Mountain grasslands |
| FRES38 | Plains grasslands |
| FRES40 | Desert grasslands |

STATES:

| | | | | | | |
|---|---|---|---|---|---|---|
| AZ | CA | CO | ID | IL | IN | IA |
| KS | MI | MN | MS | MO | MT | NE |
| NV | NM | NY | ND | OK | OR | RI |
| SD | TX | UT | WA | WI | WY | |

| | | | | | | |
|---|---|---|---|---|---|---|
| AB | BC | MB | NT | ON | SK | YK |

MEXICO

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 |
| 10 | Wyoming Basin |
| 12 | Colorado Plateau |
| 13 | Rocky Mountain Piedmont |
| 14 | Great Plains |
| 15 | Black Hills Uplift |
| 16 | Upper Missouri Basin and Broken Lands |

KUCHLER PLANT ASSOCIATIONS:

K011 Western ponderosa forest
K016 Eastern ponderosa forest
K017 Black Hills pine forest
K018 Pine-Douglas-fir forest
K019 Arizona pine forest
K022 Great Basin pine forest
K023 Juniper-pinyon woodland
K024 Juniper steppe woodlands
K037 Mountain-mahogany-oak scrub
K038 Great Basin sagebrush
K040 Saltbush-greasewood
K051 Wheatgrass-bluegrass
K055 Sagebrush steppe
K056 Wheatgrass-needlegrass shrubsteppe
K057 Galleta-threeawn shrubsteppe
K063 Foothills prairie
K064 Grama-needlegrass-wheatgrass
K066 Wheatgrass-needlegrass
K067 Wheatgrass-bluestem-needlegrass
K068 Wheatgrass-grama-buffalograss
K070 Sandsage-bluestem prairie
K075 Nebraska Sandhills prairie
K086 Juniper-oak savanna

SAF COVER TYPES:

210 Interior Douglas-fir
220 Rocky Mountain juniper
237 Interior ponderosa pine
239 Pinyon-juniper

SRM (RANGELAND) COVER TYPES:

101 Bluebunch wheatgrass
105 Antelope bitterbrush-Idaho fescue
110 Ponderosa pine-grassland
210 Bitterbrush
301 Bluebunch wheatgrass-blue grama
302 Bluebunch wheatgrass-Sandberg bluegrass
303 Bluebunch wheatgrass-western wheatgrass
304 Idaho fescue-bluebunch wheatgrass
310 Needle-and-thread-blue grama
311 Rough fescue-bluebunch wheatgrass
314 Big sagebrush-bluebunch wheatgrass
317 Bitterbrush-bluebunch wheatgrass
320 Black sagebrush-bluebunch wheatgrass
322 Curlleaf mountain-mahogany-bluebunch wheatgrass
401 Basin big sagebrush
403 Wyoming big sagebrush
404 Threetip sagebrush
405 Black sagebrush
406 Low sagebrush
412 Juniper-pinyon woodland
413 Gambel oak
414 Salt desert shrub
415 Curlleaf mountain-mahogany
501 Saltbush-greasewood
602 Bluestem-prairie sandreed
603 Prairie sandreed-needlegrass
605 Sandsage prairie
606 Wheatgrass-bluestem-needlegrass

607 Wheatgrass-needlegrass
608 Wheatgrass-grama-needlegrass
609 Wheatgrass-grama
611 Blue grama-buffalograss
612 Sagebrush-grass
613 Fescue grassland
714 Grama-bluestem
720 Sand bluestem-little bluestem (dunes)
721 Sand bluestem-little bluestem (plains)
722 Sand sagebrush-mixed prairie
724 Sideoats grama-New Mexico feathergrass-winterfat
727 Mesquite-buffalograss

HABITAT TYPES AND PLANT COMMUNITIES:

Needle-and-thread grass appears in many habitat types, including forested, grassland, and shrub-steppe communities.

In Utah, needle-and-thread grass occurs in the wheatgrass-bluegrass (Triticeae-Poa spp.) rangelands with bluebunch wheatgrass (Pseudoroegneria spicata), Sandberg bluegrass (Poa secunda), Cusick bluegrass (P. cusickii), Indian ricegrass (Achnatherum hymenoides), sand dropseed (Sporobolus cryptandrus), globemallow (Sphaeralcea spp.), balsamroot (Balsamorhiza spp.), yarrow (Achillea spp.), phlox (Phlox spp.), paintbrush (Castilleja spp.), and milkvetch (Astragalus spp.) [9].

Needle-and-thread grass also appears in the saltbush-greasewood (Atriplex spp.-Sarcobatus spp.) type in Utah with shadscale (Atriplex confertifolia), rabbitbrush (Chrysothamnus spp.), winterfat (Krascheninnikovia lanata), budsage (Artemisia spinescens), greenmolly (Kochia americana), spineless horsebrush (Tetradymia canescens), hopsage (Grayia spp.), Gardner's saltbush (Atriplex gardneri), Indian ricegrass, sand dropseed, galleta (Hilaria jamesii), greasewood, saltgrass (Distichlis spp.), alkali sacaton (Sporobolus airoides), seepweed (Suaeda spp.), and pickleweed (Allearolfea occidentalis) [9].

Other common associates of needle-and-thread grass include Utah juniper (Juniperus osteosperma), Colorado pinyon (Pinus edulis), ponderosa pine (P. ponderosa), big sagebrush (Artemisia tridentata), black sagebrush (A. nova), sand sagebrush (A. filifolia), low sagebrush (A. arbuscula), silver sagebrush (A. cana), threetip sagebrush (A. tripartita), antelope bitterbrush (Purshia tridentata), serviceberry (Amelanchier spp.), Idaho fescue (Festuca idahoensis), threadleaf sedge (Carex filifolia), mountain muhly (Muhlenbergia montana), prairie junegrass (Koeleria macrantha), elk sedge (Carex geyeri), big bluestem (Andropogon gerardii), and prairie sandreed (Calamovilfa longifolia).

Vegetation typings in which needle-and-thread appears as a dominant include:

Vegetation and soils of the Rock Springs Watershed [14]
Vegetation and soils of the Duckwater Watershed [15]
Habitat types of the Curlew National Grassland, Idaho [29]
A reconsideration of grassland classification in the northern Great Plains of North America [33]
Forest vegetation of eastern Washington and northern Idaho [42]
Structure and ecology of coniferous forests of the northern Rocky Mountains [43]
Plant communities and habitat types in the Lava Beds National Monument, California [54]
The many faces of South Dakota rangelands: description and classification [63]
Selected habitat types of the Custer National Forest [72]
The vegetation of the Grand River/Cedar River, Sioux, and Ashland Districts of the Custer National Forest: a habitat type classification [73]
The vegetation of Theodore Roosevelt National Park, North Dakota: a habitat type classification [74]
Characteristics of the Stipa comata-Bouteloua gracilis-Bouteloua curtipendula

association in northern Colorado [76]
The vegetation of Alberta [99]
Aspen community types of the Intermountain Region [100]

MANAGEMENT CONSIDERATIONS
SPECIES: Hesperostipa comata



IMPORTANCE TO LIVESTOCK AND WILDLIFE:

Needle-and-thread grass is widespread throughout the West and can be important to livestock and wildlife, especially early in the spring. The plant is preferred forage of black-tailed jackrabbits [4,38], black-tailed prairie dogs, northern pocket gophers [124], and desert cottontails [75].

PALATABILITY:

Needle-and-thread grass is moderately palatable to wildlife and domestic stock. The plant provides highly palatable early spring forage in Utah and fodder in fall and winter, but the summer fruit has a sharp awn that may injure grazing animals, especially domestic sheep [21,78,85,128,130]. Throughout the West, needle-and-thread grass is moderately important spring forage for mule deer, but use declines considerably as more preferred forages become available in summer [48].

Animal use of needle-and-thread grass is as follows [11,38,51,67,69,72,81,94,107,117,126]:

| Animal | UT | MT | CO | NV | WA |
|---|---|---|---|---|---|
| Cattle | --- | low | medium | low | medium |
| Domestic sheep | medium | ------- | ------- | good | --- |
| Bison | ------- | medium | ------- | | |
| Elk | ------- | medium | --- | medium (in Oct.) | |
| Mule deer | --- | none | low | low | ------- |
| Pronghorn | low | low | ---------- | | |

NUTRITIONAL VALUE:

In general, needle-and-thread grass' nutritional value is considered fair to deficient for cattle [61].

Nutritional content of immature needle-and-thread grass is as follows [102]:

| Nutrient | Content |
|---|---|
| Ash (%) | 12.3 |
| Crude fiber (%) | 29.0 |
| Ether extract (%) | 2.6 |
| N-free extract (%) | 44.1 |
| Protein (%) | 12.0 |
| Calcium (%) | 0.93 |
| Cobalt (mg/kg) | 0.051 |
| Phosphorus (%) | 0.16 |
| Carotene (mg/kg) | 88.2 |

Vit. A equiv. (IU/g)147.0

Late in the season, protein content drops as low as 2.9% [102].

COVER VALUE:

Needle-and-thread grass is an important component of nesting sites for sharp-tailed grouse in southwestern North Dakota [68] and in Wyoming [103].
VALUE FOR REHABILITATION OF DISTURBED SITES:

Needle-and-thread grass is useful for stabilizing eroded or degraded sites [79,94,115]. The presence of the long and tough seed awn on needle-and-thread grass reduces is usefulness as a commercial seed [78], but needle-and-thread grass hay has been used successfully in revegetation projects. In Saskatchewan, needle-and-thread grass and Canadian needlegrass (Hesperostipa spartea) mulch was used as a seed source and erosion blanket on a steep south-facing slope [47]. At a mining revegetation site near Colstrip, Montana, needle-and-thread grass successfully established on plots covered in native hay harvested locally on July 6. Ninety-two percent of the cover at the site from which the hay was harvested was needle-and-thread grass[40].

A south-facing slope on a sodium chloride contaminated mine site in North Dakota was vegetated with a mix of native grasses including needle-and-thread grass. Establishment of needle-and-thread grass after 2 years was still very low and insignificantly better on the actively reclaimed site than on the control [71].
OTHER USES AND VALUES:

No entry
OTHER MANAGEMENT CONSIDERATIONS:

Needle-and-thread grass greens up early in the spring [65,78] and may be subject to overgrazing if other forage is not available [128]. The plant goes dormant in summer, but given sufficient moisture, needle-and-thread grass will green up again in the fall [91]. The plant is particularly sensitive to defoliation from June 1 to July 31 [104]. Clipping treatments in an Idaho study caused the highest mortality in July and August [134]. Needle-and-thread grass is considered a decreaser under domestic livestock grazing pressure by most authors [8,13,23,25,26,28,33,45,84,113,120,], although others claim needle-and-thread grass increases under or is unaffected by grazing pressure [2,3,25,50,85,86,88,97]. At the Idaho National Engineering Laboratory Site, relative cover and density of needle-and-thread grass significantly ($p<0.05$) increased over 10 years of cattle grazing in a big sagebrush (Artemisia tridentata)/Indian ricegrass (Achnatherum hymenoides)-needle-and-thread grass habitat type [3].

Prairie dog activity can have a profound effect on needle-and-thread grass communities. Only 2 years after the establishment of a black-tailed prairie dog colony on a South Dakota buffalograss (Buchloe dactyloides)-Kentucky bluegrass (Poa pratensis)-needle-and-thread grass site, needle-and-thread grass no longer dominated. By 4 to 6 years of colonization, needle-and-thread grass had dropped from 97% frequency to less than 10% frequency [5,6].

BOTANICAL AND ECOLOGICAL CHARACTERISTICS
SPECIES: Hesperostipa comata

GENERAL BOTANICAL CHARACTERISTICS
RAUNKIAER LIFE FORM
REGENERATION PROCESSES
SITE CHARACTERISTICS
SUCCESSIONAL STATUS

SEASONAL DEVELOPMENT
GENERAL BOTANICAL CHARACTERISTICS:

Needle-and-thread grass is a cool-season, native, perennial bunchgrass [66]. The bunches are small, from 1 to 3 inches (2.5-7.6 cm) in diameter, and widely spaced [128].

Needle-and-thread grass is shallow-rooted [10] to medium-rooted and produces numerous fibrous roots of 0.04 inches (1 mm) or less in diameter [126]. Roots grow both vertically and laterally, more than 14 inches (36 cm) from the base of the plant in the first 0.5 foot (0.15 m) of soil. These profusely branched roots reach 3 to more than 5 feet (0.9-1.5 m) deep [34,57,116,127,126,128], but more than 50% of the total root biomass is within the first 0.6 foot (0.2 m) of soil [95]. In a Saskatchewan prairie, number of roots per shoot of needle-and-thread grass averaged 3.8 to 5.4, and the mean number of lateral roots per decimeter of main root was 39 to 75 [34].

Needle-and-thread grass is moderately to highly drought resistant [10,101,116,128] and recovers well from drought [53,116].

Needle-and-thread grass is colonized by vesicular-arbuscular mycorrhizae (VAM). In a study in northern Nevada, 83% of plants within a grazing exclosure were colonized with VAM, while only 33% of grazed plants were colonized, a significant ($p<0.05$) difference [13].
RAUNKIAER LIFE FORM:

Hemicryptophyte
REGENERATION PROCESSES:

Propagation is by seed [94] and by tillers [1,46,128]. Seeds are long-lived. Sixty-three percent of seeds stored in an open warehouse in Utah germinated after 9 years [120]. Seeds may germinate in spring or fall, but more commonly in the fall [52]. Because of a long awn on the seed, needle-and-thread grass seeds can imbed themselves in the soil by a twisting action of the awn in response to daily humidity changes [52,92].

Needle-and-thread grass seeds are not a prominent component of soil seedbanks. Hassan and West [77] studied soil seedbank properties under burned and unburned Wyoming big sagebrush (Artemisia tridentata ssp. wyomingensis)-Utah juniper-bunchgrass sites in Utah. Despite relatively high presence of needle-and-thread grass as ground cover, there were very few viable needle-and-thread grass seeds in the upper 2 inches (5 cm) of soil on both the burned and unburned treatments.

In a Nebraska sandhills prairie site, needle-and-thread grass contributed the fewest seeds to the 0 to 2 inch (0-5 cm) depth seedbank of several perennial grasses [107]. Only 2% of needle-and-thread grass seeds germinated in greenhouse germination trials.
SITE CHARACTERISTICS:

Needle-and-thread grass is common on dry hills and plains, and on stony and sandy soils throughout its range [36,130]. Soils are usually slightly high pH, low water-holding capacity, low clay percentage and high bulk density [108]. On the Upper Snake River Plains in Idaho, needle-and-thread grass is common on sandy soils and dry areas [11]. In southwestern Saskatchewan, needle-and-thread grass often dominates on loam soils but is usually absent from heavy clays [83].

Needle-and-thread grass occurs on well-drained soils from 660 to 11,550 feet (200-3500 m) in California [79]. In Arizona, needle-and-thread grass occurs from 3,500 to 8,500 feet (1061-2576 m) on dry hills, open woods, and sandy soils, often with juniper [89]. In Montana, needle-and-thread is found from 2,000 to 8,000 feet (606-2424) [116]. In Utah, needle-and-thread occurs from 3,498 to 10,065 feet (106-3050 m) [130].

Needle-and-thread grass generally requires at least 10 inches (254 mm) of annual precipitation [44] but grows in areas with less [130]. In Montana, needle-and-thread grass grows best with 10-18 inches (254-457 mm) of precipitation [116]. The aspect on which needle-and-thread grass appears most frequently varies by geographic location. In the sandhills of Nebraska, needle-and-thread grass is commonly found on north-facing slopes [23]. In Saskatchewan, needle-and-thread grass reaches highest densities on warm, dry, upper, south-facing slopes [19]. In Alberta, needle-and-thread grass is largely restricted to south-facing slopes and is most dense on the upper slopes [35]. In eastern Colorado, needle-and-thread grass is most common on north and east-facing slopes [39].In Montana, needle-and-thread grass performs worst on southwest slopes [94].

At the Idaho National Engineering Laboratory Site, density and frequency of needle-and-thread grass was significantly ($p<0.01$) correlated with April precipitation, but not with May or June precipitation [60].

SUCCESSIONAL STATUS:

Needle-and-thread grass is generally a mid-seral species. Needle-and-thread is considered an early seral species in Montana [94] and Wyoming [113], following the 1st annual forbs and grasses and biennial forbs. Needle-and-thread grass is a mid-successional species in semi-arid big sagebrush communities in Colorado [58].

Freeman and Emlen [59] evaluated interspecific competition in a cold desert shrub community in western Utah. They found needle-and-thread grass was negatively affected by competition with Indian ricegrass, galleta, blue grama (Bouteloua gracilis), shadscale, saltbush, winterfat, and cheatgrass (Bromus tectorum), and positively associated with the forbs sand dropseed and red threeawn (Aristida purpurea).

Germination of needle-and-thread grass seeds is strongly inhibited by aqueous extracts of absinth wormwood (Artemisia absinthium) but positively affected by extracts of fringed sagewort (A. frigida) and tarragon (A. dracunculus) [82].

In wetter than average moisture conditions, needle-and-thread grass may be replaced by wheatgrass (Triticeae) and Canadian needlegrass [32].

SEASONAL DEVELOPMENT:

Needle-and-thread grass becomes dormant during hot weather, but it will green up again in the fall given sufficient precipitation [92,128]. According to Wright [132], needle-and-thread grass never becomes truly dormant in the summer in Idaho. Seasonal development of needle-and-thread grass in the Great Plains is as follows [128]:

| Stage | Approx. date |
|---|---|
| Growth resumes | Late March, early April |
| Flowering | Early June |
| Ripe seeds shed | July |

On the Upper Snake River Plain, Idaho, seasonal development is as follows [11]:

| Stage | Date |
|---|---|
| Growth starts | 4/4 |
| Flowerstalks appear | 5/21 |
| Heads fully out | 6/18 |
| Flowers in bloom | 6/22 |
| Seed ripe | 7/1 |
| Dissemination starts | 7/4 |
| Dissemination over | 7/20 |
| Plant drying | 7/3 |

Plant dried8/1

FIRE ECOLOGY
SPECIES: Hesperostipa comata

FIRE ECOLOGY OR ADAPTATIONS
POSTFIRE REGENERATION STRATEGY

FIRE ECOLOGY OR ADAPTATIONS:
Needle-and-thread grass sprouts from the caudex following fire, if heat has not been sufficient to kill underground parts [1,46].

Mean fire intervals for needle-and-thread grass depend on the habitat type in which the grass appears. In ponderosa pine/bunchgrass habitats in the northern Rocky Mountains, east of the Cascade Range, and in the Blue Mountains, mean fire intervals are estimated from 6 to 22 years [135]. In big sagebrush/grass communities in Yellowstone National Park, Wyoming, presettlement mean fire intervals are estimated at 17 to 41 years [138]. Needle-and-thread grass is a common component of pinyon-juniper woodlands which are estimated to have burned every 10 to 30 years prior to fire suppression [138].

POSTFIRE REGENERATION STRATEGY:
Tussock graminoid
Initial-offsite colonizer (off-site, initial community)

FIRE EFFECTS
SPECIES: Hesperostipa comata

IMMEDIATE FIRE EFFECT ON PLANT
DISCUSSION AND QUALIFICATION OF FIRE EFFECT
PLANT RESPONSE TO FIRE
DISCUSSION AND QUALIFICATION OF PLANT RESPONSE
FIRE MANAGEMENT CONSIDERATIONS

IMMEDIATE FIRE EFFECT ON PLANT:
Needle-and-thread grass is top-killed by fire. It may be killed if the aboveground stems are completely consumed [22]. Needle-and-thread grass in sagebrush ecosystems is classified as slightly damaged by fire [106,110,111,], and in Intermountain rangelands, as severely damaged [139].

Wright and Klemmedson [137] performed burning studies on needle-and-thread grass plants in Idaho. Burning in June killed more than 90% of needle-and-thread grass plants, while only 20% burned in July died, and none burned in August died. Needle-and-thread grass' dense culms, with a lot of dead material, will continue to burn after the fire has burned over the stand; resulting temperatures can be lethal to underground parts[134,136,137,139]. Charring down into the growing points is noticeable in needle-and-thread grass plants following burning [134]. Large plants are more susceptible to fire kill than smaller plants [139].

Some studies indicate that needle-and-thread grass becomes more resistant to burning from spring through summer as tissues dry out and root storage of carbohydrates increases [1,95,134]. However, this finding contradicts Wright [133], who claimed mortality of needle-and-thread following burning peaks in July and August and declines slightly in September.

Wright [133] claims that the large amounts of dead material in needle-and-thread grass culms cause the plant to burn completely regardless of weather or fire

conditions, and that complete defoliation can itself result in mortality, regardless of heat effects in the base of the culm [134].

DISCUSSION AND QUALIFICATION OF FIRE EFFECT:
No entry
PLANT RESPONSE TO FIRE:
Needle-and-thread sprouts from the caudex following fire [1,46]. Recovery generally takes 2 to 10 years [138,139].

Post-fire productivity and coverage usually decrease for 1 season and then increase in the following year, although this response is not consistent. In Wind Cave National Park, South Dakota, needle-and-thread grass coverage decreased for the 1st season following a spring prescribed burn and then rapidly increased in the following 2 seasons [56]. Following a prescribed burn and a wildfire elsewhere in the southern Black Hills, South Dakota, needle-and-thread grass production was significantly higher ($p<0.05$) on the burned than on unburned control plots in the 1st year following the fire [20]. Following an August wildfire in eastern Idaho in a curlleaf mountain mahogany (Cercocarpus ledifolius)/bluebunch wheatgrass type, needle-and-thread grass frequency and coverage percentage slightly increased in the 1st year over an unburned control [30]. In North Dakota, 2 years following a prairie fire, needle-and-thread grass cover increased by 100% [90].

In contrast, in the Nebraska Sandhills, a lightning strike started a fire in October in a sand bluestem (Andropogon gerardii var. paucipilus)-little bluestem (Schizachyrium scoparium)-prairie sandreed (Calamovilfa longifolia)-needle-and-thread grass-blue grama (Bouteloua gracilis)-hairy grama (B. hirsuta)-spike dropseed (Sporobolus cryptandrus) grassland. In the following year, needle-and-thread grass biomass on unburned sites was not significantly different from biomass on burned sites in June, July, and August, but by October, biomass on unburned sites was higher ($p<0.05$) [98].

Fire did not affect the root biomass of needle-and-thread grass following a late-summer fire in a northern Nevada grassland [95].

Blank and Young [18] studied the effects of heating the substrate and exposing seeds to burned soil and big sagebrush smoke on needle-and-thread grass seedling emergence, and plant growth response to aqueous extracts of heated soil and smoke. Emergence rate and maximum emergence of seedlings of needle-and-thread grass were significantly ($p<0.05$) greater in heated substrates than controls. However, exposure to sagebrush smoke significantly reduced the rate of and maximum emergence of needle-and-thread grass. When seeds were pretreated with smoke, needle-and-thread grass had significantly greater leaf elongation rates for the first 30 days of growth. Number of leaves, rate of leaf formation, and above- and belowground biomass were also higher following smoke treatment. Soaking in the soil solution resulted in significantly less aboveground biomass than the control. The authors did not identify the agent in sagebrush smoke that resulted in these growth effects.

In Wind Cave National Park, a spring (April 21) prescribed burn in 1976 in a mixed grass prairie association resulted in significantly greater ($p<0.10$) yield of needle-and-thread grass over the unburned control in the 1st year following the fire, and significantly less ($p<0.10$) yield in the 2nd year [114]. The authors explained these differences by the 2nd year having lower precipitation, and an observed stimulation of flowering, in both inflorescence numbers and size, in the 1st year after burning.

In contrast, in Idaho, the number of inflorescences per needle-and-thread grass plant decreased following fire [41]. In North Dakota, in the 1st year following a spring burn, no needle-and-thread grass inflorescences were found [49].

In Wind Cave National Park, needle-and-thread grass decreased in frequency

following 2 spring burns. The author postulated that the mild preceding winters caused the grass to green up earlier than usual, and therefore, it was at an advanced phenological point and more susceptible to fire damage than it usually would be in April [118].

On an upland mixed-grass prairie site in Badlands National Park, South Dakota, burning needle-and-thread grass in April and October both reduced aboveground biomass ($p<0.05$) for up to 3 growing seasons. The authors concluded that the greater damage occurred in April because the plants were actively growing, unlike October, and that needle-and-thread grass is intolerant to both spring and fall burning [131].

DISCUSSION AND QUALIFICATION OF PLANT RESPONSE:
Following a lightning-caused fire in the Nebraska sandhills, needle-and-thread grass coverage increased 12% on burned hilltops but decreased 16% on north and south-facing slopes [23].

Fall prescribed burning in east-central Oregon had no significant effect on needle-and-thread grass frequency in postfire year 1 or 2. See the Research Project Summary of this work for more information on fire effects on needle-and-thread grass and 60 additional grass, forb, and woody plant species.

FIRE MANAGEMENT CONSIDERATIONS:
A big sagebrush-steppe community type that burned naturally in late summer was studied to determine the effects of cheatgrass competition on the recovery and growth of needle-and-thread grass. Needle-and-thread grass plants had significantly less ($p<0.05$) biomass in the study plots in which they competed with cheatgrass than in those in which they did not. The authors concluded that cheatgrass depletes the soil water quickly and takes advantage of soil spaces left by plants killed by the fire. Cheatgrass uses the water before needle-and-thread grass [96]. Fall is generally the least harmful season for burning needle-and-thread grass in terms of survival percentage. However, mortality in needle-and-thread grass appears to be related to the amount of dead material in the plant culm, and mortality may occur regardless of the season of the burn or burn conditions. Heavy grazing prior to a burn may reduce dead material and improve survivorship of needle-and-thread grass [134].

FIRE CASE STUDIES
SPECIES: Hesperostipa comata

1st CASE STUDY: Needle-and-thread grass regeneration after prescribed fire in Dinosaur National Monument, Colorado

2nd CASE STUDY: Effects of prescribed fire on needle-and-thread grass in a Idaho big sagebrush/bunchgrass community on the Snake River Plains
3rd CASE STUDY: Needle-and-thread grass response to spring burning in western South Dakota

1st CASE STUDY:

FIRE CASE STUDY CITATION
REFERENCE
SEASON/SEVERITY CLASSIFICATION
STUDY LOCATION
PREFIRE VEGETATIVE COMMUNITY
TARGET SPECIES PHENOLOGICAL STATE

SITE DESCRIPTION
FIRE DESCRIPTION
FIRE EFFECTS ON TARGET SPECIES
FIRE MANAGEMENT IMPLICATIONS

FIRE CASE STUDY CITATION:
Zlatnik, Elena. 1999. Needle-and-thread grass regeneration after prescribed fire in Dinosaur National Monument, Colorado. In: Hesperostipa comata. 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/ [2011, February 23].

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SEASON/SEVERITY CLASSIFICATION:

The fire took place on September 14, 1995. Temperatures were 82 to 84 degrees Fahrenheit (28-29 oC), relative humidity was 17%, and winds were 8 to 12 miles/h (13-19 km/h).

STUDY LOCATION:

The burn took place at Iron Springs Bench, Dinosaur National Monument, Dinosaur, Colorado.

PREFIRE VEGETATIVE COMMUNITY:

The study plots represented two prefire communities--a big sagebrush (Artemisia tridentata)/grass community dominated by sagebrush, thickspike wheatgrass (Elymus lanceolatus), needle-and-thread grass (Hesperostipa comata), and Indian ricegrass (Achnatherum hymenoides), and a perennial grassland featuring the same grass species.

TARGET SPECIES PHENOLOGICAL STATE:

Grasses were dormant, mature plants with current year inflorescences.

SITE DESCRIPTION:

No entry

FIRE DESCRIPTION:

Fire behavior on the big sagebrush/grass plots was as follows:
Rate of spreadflame lengthflaming frontresidence time in sagebrush
1809-2010 m/h3 m3-4.5 m20 sec. or less

Fire characteristics were not measured in the perennial grass plot. However, residence time was apparently lower, around 10 seconds, due to lower fuel loading.

FIRE EFFECTS ON TARGET SPECIES:

On the sagebrush/grass plots, 74% of needle-and-thread grass plants regenerated from the caudex in 1996, the year following the burn. In 1996, only 4% of the surviving plants produced seed, but by 1997, 100% produced seed. In 1997, 6 plants that were absent (and presumed killed) in 1996 resprouted and produced seed, and 5 plants present in 1996 were not found in 1997.

On the perennial grass plots, 92% of plants regenerated from the caudex in 1996, 1 year after the burn. By 1997, regeneration was 99%. In 1996, 14% of plants

produced seed, but by 1997, 99% did.
FIRE MANAGEMENT IMPLICATIONS:

Needle-and-thread grass regenerates following fire from the surviving underground root system. Plants that fail to regenerate or produce seed in the 1st season following fire may still recover in the 2nd year.

2nd CASE STUDY:

FIRE CASE STUDY CITATION
REFERENCE
SEASON/SEVERITY CLASSIFICATION
STUDY LOCATION
PREFIRE VEGETATIVE COMMUNITY
TARGET SPECIES PHENOLOGICAL STATE
SITE DESCRIPTION
FIRE DESCRIPTION
FIRE EFFECTS ON TARGET SPECIES
FIRE MANAGEMENT IMPLICATIONS

FIRE CASE STUDY CITATION:

Zlatnik, Elena. 1999. Effects of prescribed fire on needle-and-thread grass in a Idaho big sagebrush/bunchgrass community on the Snake River Plains. In: Hesperostipa comata. 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/ [2011, February 23].
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SEASON/SEVERITY CLASSIFICATION:

August 1936/severity not given
STUDY LOCATION:

U.S. Sheep Experiment Station, 11 miles northeast of Dubois, Clark County, Idaho

PREFIRE VEGETATIVE COMMUNITY:

This was a big sagebrush (Artemisia tridentata)/bunchgrass site, with 35% perennial grasses, including thickspike wheatgrass (Elymus lanceolatus), plains reedgrass (Calamagrostis montanesis), sedges (Carex spp.), junegrass (Koeleria macrantha), Sandberg bluegrass (Poa secunda), and needle-and-thread grass (Hesperostipa comata); 5% perennial forbs; 5% annual forbs; 40% big sagebrush; and 15% downy rabbitbrush (Chrysothamnus viscidiflorus var. puberulus), spineless gray horsebrush (Tetradymia canescens var. inermis), and miscellaneous other shrubs.
TARGET SPECIES PHENOLOGICAL STATE:

Seeds had been disseminated and plants were dry or nearly dry. The site had not been grazed the previous growing season in order to have sufficient fuels to carry the fire.
SITE DESCRIPTION:

The study site was at approximately 6,000 feet (1830 m) elevation, with 11 inches (279 mm) annual precipitation, with sandy soils of basaltic origin. Dry southwestern winds during the summer months make this an arid site, with 100

degrees Fahrenheit (38˚C) temperatures possible in the summer and -35 degrees Fahrenheit (-37˚C) in the winter.
FIRE DESCRIPTION:

The fire burned in a mosaic pattern, with scattered unburned islands. Immediately following the burn, the study plots were classified according to the following definitions: 1) heavily burned–trunk or main stem of big sagebrush consumed, 2) moderately burned–larger branches of sagebrush remaining but smaller ones consumed, 3) lightly burned–only leaves consumed, and 4)unburned–no evidence of fire in brush or understory.
FIRE EFFECTS ON TARGET SPECIES:

Production of needle-and-thread grass following the fires was not significantly different under any treatment.
FIRE MANAGEMENT IMPLICATIONS:

The author concluded that needle-and-thread grass would experience a 1st year set back in production following burning, and then increase production in the following years. Needle-and-thread grass was not reduced by the burn.

3rd CASE STUDY:

FIRE CASE STUDY CITATION
REFERENCE
SEASON/SEVERITY CLASSIFICATION
STUDY LOCATION
PREFIRE VEGETATIVE COMMUNITY
TARGET SPECIES PHENOLOGICAL STATE
SITE DESCRIPTION
FIRE DESCRIPTION
FIRE EFFECTS ON TARGET SPECIES
FIRE MANAGEMENT IMPLICATIONS
FIRE CASE STUDY CITATION:

Zlatnik, Elena. 1999. Needle-and-thread grass response to spring burning in western South Dakota. In: Hesperostipa comata. 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/ [2011, February 23].
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Gartner, F. R.; Lindsey, J. R. 1986. Vegetation responses to spring burning in western South Dakota. In: Clambey, Gary K.; Pemble, Richard H., eds. The prairie: past, present and future: Proceedings, 9th North American prairie conference; 1984 July 29 - August 1; Moorhead, MN. Fargo, ND: Tri-College University Center for Environmental Studies: 143-146. [64].
SEASON/SEVERITY CLASSIFICATION:

April 21, 1976/severity not given
STUDY LOCATION:

Wind Cave National Park, Black Hills, South Dakota.
PREFIRE VEGETATIVE COMMUNITY:

This was a ponderosa pine (Pinus ponderosa) and mixed-grass prairie site, featuring a western wheatgrass (Pascopyrum smithii)-needle-and-thread grass plant community. Species present included green needlegrass (Nassella viridula), bluegrasses (Poa spp.), grama grasses (Bouteloua spp.), sedges (Carex spp.), forbs, and shrubs.

TARGET SPECIES PHENOLOGICAL STATE:

Needle-and-thread grass was in early growth.
SITE DESCRIPTION:

The study area was located on a nearly level bench, with average annual precipitation of 16.6 inches (422 mm), mostly in the summer. The soils in the study area were deep silt loams, derived from underlying gypsiferous red shales. Silty clay subsoils layers were calcareous at about 15 inches (38 cm).
FIRE DESCRIPTION:

Conditions at the time of the fire were: winds southeast 8 to 12 mph (19-24 km/h), temperature 70 degrees Fahrenheit (20 ˚C), and relative humidity 40%. Most of the area was burned with a strip-headfire and a flank fire, due to shifting winds.
FIRE EFFECTS ON TARGET SPECIES:

In 1976, the year of the fire, needle-and-thread grass yield was significantly ($p<0.10$) higher in the burn than in the unburned control. In the following year, yield was significantly lower. The year following the burn received lower than average annual precipitation, and mean yields of all vegetation measured were lower on both burned and unburned plots. The authors attributed this decrease to droughty conditions.

Flowering was stimulated on the burned needle-and-thread grass plots for the 1st season following the fire (1976).
FIRE MANAGEMENT IMPLICATIONS:

The authors concluded that burning increased the yields of desirable native species, decreased the presence of exotics, and had a net benefit on the health of the study sites.

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