Phalaris arundinacea

INTRODUCTORY

Photo by John M. Randall, The Nature Conservancy, Bugwood.org

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FEIS ABBREVIATION:
PHAARU

NRCS PLANT CODE [282]:
PHAR3

COMMON NAMES:
reed canarygrass
canary grass
reed canary grass
reed canary-grass
speargrass

ribbon grass

gardener's gaiters

TAXONOMY:
The scientific name of reed canarygrass is *Phalaris arundinacea* L. (Poaceae) [14,83,87,111,113,141,187,192,298]. A variegated type, *Phalaris arundinacea* var. *picta* L. or ribbon grass, also occurs in North America [14]. Reed canarygrass has been bred for cultivation and at least 11 cultivars have been developed [102].

Terminology used to describe reed canarygrass' phenotypic variability (e.g., strains, types, genotypes, ecotypes) is inconsistent in the literature. This review uses the terminology from the original publications unless it is unclear and/or inconsistent with that in other pertinent literature.

SYNONYMS:
for *Phalaris arundinacea* L.
Phalaroides arundinacea L. Raeusch. [243]

for *Phalaris arundinacea* var. *picta* L.
Phalaris arundinacea f. *variegata* (Parnell) Druce [290,298]

LIFE FORM:
Graminoid

DISTRIBUTION AND OCCURRENCE

SPECIES: Phalaris arundinacea

- GENERAL DISTRIBUTION
- HABITAT TYPES AND PLANT COMMUNITIES

GENERAL DISTRIBUTION:
Reed canarygrass occurs throughout most of the continental United States with the exception of Texas, Louisiana, Mississippi, Florida, Georgia, and South Carolina. It occurs north throughout Canada and into Alaska [282] and as far south as northern Mexico [298]. Allard and Evans [3] indicated that reed canarygrass' North American distribution is likely a reflection of its need for long days for flowering (see Seasonal Development). Reed canarygrass is common in the northern half of the United States and southern third of Canada [76], especially in the Pacific Northwest [57,83,184,257,283], the northern Rocky Mountains [252], the north-central states [251,252,257,283], and the Great Lakes states [245,283]. Plants Database provides a map of reed canarygrass' North American distribution, excluding Mexico.

Reed canarygrass is a circumboreal species and occurs in the temperate regions of 5 continents [76,83,131,257]. It is generally considered native to temperate parts of Europe, Asia [2,119,187,301,306], and North America [14,50,83,87,111,113,187,192,298], and may be native to Pakistan and Kashmir [2]. It has been introduced to parts of the southern hemisphere [87], specifically New Zealand, Australia [131], and South America [298]. Cultivation of reed canarygrass began as early as 1749 in Sweden, and it has been cultivated extensively throughout Europe; cultivation in North America was first reported in New England in the 1930s (using ribbon grass) [4]. Reed canarygrass has been widely cultivated in North America from introduced European cultivars [76,195,246,250], making its pre-agricultural distribution uncertain. Galatowitsch and others [76] suggest that reed canarygrass is a species whose origin cannot be positively determined.

Native status in North America: There is some confusion as to the native status of reed canarygrass in North America. Most North American floras treat reed canarygrass as a native species [14,50,83,87,111,113,187,192,298]. Publications from the inland Northwest [94,97,205], New Mexico [220], the Great Plains [59], the Great Lakes area

[53,128,130,195,246], Pennsylvania [309], Ontario [58], and Manitoba [213] consider reed canarygrass native in their area. However, a few publications regard reed canarygrass as a nonnative in the Pacific Northwest [185,274,301].

Evidence that reed canarygrass is native to at least some locations in North America includes a study of historical documents and herbaria records of reed canarygrass collected in the inland northwestern United States prior to widespread European settlement in that area [205]. Similarly, a study of herbaria records in Quebec found a few specimens of reed canarygrass collected from remote locations during the 19th century, supporting the contention that it is native there [170].

Invasive populations of reed canarygrass occur in many areas throughout its range, particularly in the northwestern [35,66,188,234,248] and north-central [15,145,196,240] United States, and increasingly in eastern North America [170]. It is generally thought that invasive populations are comprised of either nonnative strains or hybrids between nonnative and native strains [58,196,205,246,271]. Researchers in Ontario [58] observed noninvasive populations of reed canarygrass in "native habitats" along the shores of the northern Great Lakes and the upper Ottawa and French rivers, as well as invasive populations in anthropogenically altered landscapes. They speculated that noninvasive populations were native, while invasive populations were the progeny of European cultivars [58]. A genetic analysis of populations in Europe and North America (Vermont and New Hampshire) indicates that invasive populations of reed canarygrass in North America are comprised of genotypes resulting from multiple introductions of European cultivars and subsequent interbreeding of these populations [169]. The long history of repeated introductions of reed canarygrass into North America has resulted in substantially higher within-population genetic diversity in its introduced range as compared with its native range, allowing for rapid selection of novel genotypes and increased invasive potential [169]. See Genetic variability for a discussion of variable traits that may influence the invasiveness of reed canarygrass.

Native populations of reed canarygrass that have not been exposed to gene flow from nonnative strains may no longer occur in North America. Additionally, morphological variability makes it difficult, if not impossible, to distinguish between native and nonnative populations [205]. Decisions to control populations of reed canarygrass may be based on its impacts in a given area rather than its ambiguous native status.

HABITAT TYPES AND PLANT COMMUNITIES:

In North America, reed canarygrass occurs in many wetland plant communities including wet meadows, prairie potholes, marshes, riparian areas, and peatlands (i.e., fens, bogs). It may occur as an occasional species [94,159,307], a codominant species [156,159,243], or a dominant species [94,97,197,220,235,270], sometimes forming monotypic stands [94,97,197,220,271].

In marshes, wet meadows, and prairie potholes, reed canarygrass may comprise from >50% [235] to 100% of the vegetation cover [94,97,159,197,220]. On sites where it is less abundant, it occurs with a mix of graminoids, forbs, shrubs, and trees. It commonly occurs in sedge (*Carex* spp.) dominated communities [11,23,41,51,56,104,159,166,197,220,244,245]. It is a common associate of other graminoid plant communities dominated by reedgrasses (*Calamagrostis* spp.) [41,51,56,73,166,244], bulrushes (*Scirpus* spp.) [60,157,243,244,310], fowl mannagrass (*Glyceria striata*) [178,220,244], rice cutgrass (*Leersia oryzoides*) [68,244], and nonnative pasture grasses [18,49,94,103,114,159]. In marshes, reed canarygrass' distribution often overlaps with cattail (*Typha* spp.) [40,68,94,157,271] and nonnative purple loosestrife (*Lythrum salicaria*) [174,212,226,256,304]; however, reed canarygrass may not dominate these communities [94]. In the central grassland states, reed canarygrass is often associated with stands of prairie cordgrass (*Spartina pectinata*) [41,56,243,294]. Reed canarygrass has been observed in sphagnum (*Sphagnum* spp.) bogs, particularly in the Great Lakes states, in a tamarack (*Larix laricina*) bog with red maple (*Acer rubrum*) [206], and in other plant communities with bog birch (*Betula glandulosa*) [310], sweetgale (*Myrica gale*), and smooth sawgrass (*Cladium mariscoides*) [78].

In riparian areas, reed canarygrass may occur with a mix of woody species and forbs, in addition to the graminoids previously described [15,150,197,223,293], or it may occasionally dominate the understory [66,97,235]. In riparian areas, reed canarygrass is most commonly associated with willow (*Salix* spp.) [49,150,182,197,204,235], and to a lesser degree, dogwood (*Cornus* spp.) [49,132], alder (*Alnus* spp.) [49,132], birch (*Betula* spp.) [15,49,235], hawthorn (*Crataegus* spp.) [48,49], desert false indigo (*Amorpha fruticosa*) [262], and nonnative Russian-olive (*Elaeagnus* *angustifolia*) [30,223]. In the Northwest, reed canarygrass occasionally occurs in riparian forests with cottonwood (*Populus* spp.) [65,204] or Oregon ash (*Fraxinus latifolia*) [197]; in the Great Plains with eastern cottonwood (*Populus deltoides*) [150]; in the Great Lakes states and south-central Canada with eastern cottonwood [15,40], silver maple (*Acer saccharinum*) [15,203,293], green ash (*Fraxinus pennsylvanica*) [15,166,203], American elm (*Ulmus americana*) [132,166,203], and various other deciduous trees [166,203]; and in the Northeast with silver maple and American elm [235].

A few publications suggest that reed canarygrass may occur in oak (*Quercus* spp.)-dominated woodlands in the Pacific Northwest (review by [6]) and Wisconsin [106,202]. One review indicates that reed canarygrass occurs in boreal forests along the coast of Alaska [55].

The following table shows characteristics of habitat types and plant communities in North America where reed canarygrass is a dominant, codominant, or characteristic species.

Vegetation classifications from North America where reed canarygrass is a dominant, codominant, or characteristic species		
Vegetation Classification	Location	Dominant plants and other features
Pacific Northwest		
Columbian sedge (*Carex aperta*) community type	northwestern Oregon	Columbian sedge and reed canarygrass may codominate. Reed canarygrass cover may reach 97% and can completely displace Columbian sedge [197].
Kentucky bluegrass (*Poa pratensis*) community type	Washington	Nonnative grasses, Kentucky bluegrass, redtop (*Agrostis gigantea*), Oregon bentgrass (*A. oregonensis*), and reed canarygrass codominate [159].
reed canarygrass community type	Pacific Coast in Washington	Reed canarygrass monoculture that resulted from seeding reed canarygrass
thistle community	Pacific Coast in Washington	Canada thistle (*Cirsium arvense*), reed canarygrass, and common velvet grass (*Holcus lanatus*) codominate [270].
Inland Northwest		
Pacific willow (*S. lucida* subsp. *lasiandra*) community type	Montana	Pacific willow average cover may reach 59% and reed canarygrass average cover may reach 60% [97].
reed canarygrass habitat type	Montana, Idaho	Reed canarygrass maintains nearly 100% cover. This is a major habitat type in western Montana and a minor type in eastern Idaho and central and eastern Montana [94,97].
Southwest		
reed canarygrass plant alliance	Pecos, Rio Grande, and San Juan river basins in New Mexico	Reed canarygrass constitutes ≥ 90% cover. This alliance occurs in sloughs and marshes bordering secondary channels of wide floodplains. It may contain some native plants [220].
Central Grasslands		
common spikerush (*Eleocharis palustris*) plant alliance	Oregon to Montana, south to California, Arizona, New Mexico; may occur in eastern Washington	Reed canarygrass codominates this alliance with other emergents such as common spikerush, Baltic rush (*Juncus balticus*), clustered field sedge (*Carex praegracilis*), bulrush, switchgrass (*Panicum virgatum*), prairie cordgrass, and various forbs. This alliance is characterized by rhizomatous perennials that dominate the graminoid layer [243].

reed canarygrass seasonally flooded herbaceous alliance	eastern Montana, within the Great Plains bioregion [255]	None described
Northeast		
reed canarygrass riverine grassland	Delaware Water Gap National Recreation Area; boundary of New Jersey and Pennsylvania	Reed canarygrass cover >50% [235]
black willow (*S. nigra*)/reed canarygrass-Indianhemp (*Apocynum cannabinum*)	Delaware Water Gap National Recreation Area	Willows, sycamore (*Platanus occidentalis*), nonnative purple loosestrife, Indianhemp, marshpepper knotweed (*Polygonum hydropiper*), and reed canarygrass [235]
silver maple floodplain forest	Delaware Water Gap National Recreation Area	Silver maple dominates the canopy and reed canarygrass forms dense stands in the herbaceous layer [235].
Canada		
black cottonwood (*Populus balsamifera* subsp. *trichocarpa*)-reed canarygrass plant association	coast of British Columbia	Black cottonwood, willow, and red alder (*Alnus rubra*) dominate the tree layer. The dense deciduous shrub layer is typically dominated by red-osier dogwood (*Cornus sericea*), twinberry honeysuckle (*Lonicera involucrata*), devil's club (*Oplopanax horridus*), stink current (*Ribes bracteosum*), thimbleberry (*Rubus parviflorus*), and salmonberry (*R. spectabilis*). Reed canarygrass is present in the herbaceous understory and may be dominant. This association may occur in submontane and montane zones in annually flooded sites [156].
reed canarygrass/red-osier dogwood	Quebec	Occurs in wet meadows [81]
silver maple with reed canarygrass forest	Quebec	Silver maple dominates the overstory, red-osier dogwood is common in the shrub layer, and reed canarygrass dominates the herb layer. This plant community occurs on low graded lakeshore slopes on poorly drained soils such as clay or clay loam [287].

BOTANICAL AND ECOLOGICAL CHARACTERISTICS

SPECIES: Phalaris arundinacea

- GENERAL BOTANICAL

Photo by Chris Evans, River to River CWMA, Bugwood.org

GENERAL BOTANICAL CHARACTERISTICS:

Botanical description: This description covers characteristics that may be relevant to fire ecology and is not meant for identification. Keys for identification are available (e.g., [112,113,187,268,298]).

Aboveground: Reed canarygrass is a rhizomatous perennial grass that grows from 2 to 7 feet (0.6-2 m) tall [64,83,87,112,113,194,241,268,298]. It has broad, flat leaves that are 5 to 25 mm wide [64,222,268,298] and a hollow stem [238]. Leaves are typically green but may be variegated [58,112,113,290,298]. Reed canarygrass' spikelets are 3-flowered [298] and occur on a narrow panicle 2 to 12 inches (5-30 cm) long [64,83,112,187,194,222,268]. The fruit is 1.5 [111] to 4 mm long [64,289] and from 0.7 to 1.5 mm wide [64,111]. Because no morphological characteristics clearly distinguish the native reed canarygrass from the nonnative types, discrimination between the two types is difficult ([58,205], review by [119]).

Belowground: Reed canarygrass spreads by creeping rhizomes [99,112,131,143,194,214,222]. Its rhizomes are stout [131], long [238], and scaly [87]. New rhizomes originate almost entirely below the soil surface from buds at the nodes of other rhizomes [62] but may occasionally develop at the base of the aboveground shoots from buds in the axils of the leaves [63]. Under experimental conditions, reed canarygrass rhizomes were 1.6 [62,63] to about 4 inches [219] (4.1-10 cm) long and were located in the upper 1 to 5 inches (3-13 cm) of soil [219]. In Idaho, wild populations of reed canarygrass form dense, rhizomatous root mats in the upper few inches of the soil [94]. Rhizomes grown in wet soils were longer (maximum length 4 inches) than those grown in dry loam garden soils (maximum length 2.5 inches), and rhizomes grown in sand averaged 1 inch (3 cm) long. In an experimental garden, 1 square meter of loam contained about 383 feet (117 m) of rhizomes [219]. In monotypic stands of reed canarygrass in the Czech Republic, all rhizomes and over half of the root system occurred in the upper 8 inches (20 cm) of soil [154]. Under experimental conditions, reed canarygrass rhizomes grow out from beneath the grass clumps and form culms [62,219]. Roots and rhizomes may form an almost impenetrable sod [62,219].

Stand structure: Reed canarygrass forms large clumps [250] that may be as wide as 3 feet (1 m) across [283]. On many sites reed canarygrass forms dense monotypic stands [7,15,94,148,184,195,240,260,271,301]. Reed canarygrass may grow as a sward (i.e., lawn-like) or occasionally create tussocks [108,299].

Genetic Variability: Differences in reed canarygrass production rates [169], photosynthetic characteristics [27], forage yields [252], seedling survival rates [218], growth response to vegetation density [217], and capacity to produce a new stand through vegetative regeneration [36] have been attributed to its high genetic variability. Genetic variation may influence reed canarygrass' invasive potential [27] and may have facilitated its spread in North America [169].

Raunkiaer [242] life form:
Geophyte

SEASONAL DEVELOPMENT:
The following is a summary of available literature on reed canarygrass phenology from various parts of North America.

In North America, reed canarygrass begins to grow in early spring, typically April [5,133,157,294,301]. One report from the Great Plains [117] and another from New Jersey [171] indicate that reed canarygrass seedlings emerge in the spring. In the Pacific Northwest, reed canarygrass may begin to grow in late winter (review by [5]). Reed canarygrass continues to grow vertically throughout the spring and early summer ([301], review by [133]) and then may start to expand laterally via rhizomes (review by [133]). In Oregon, reed canarygrass grows substantially in the spring before flood waters recede [301]. Various reviews from the Pacific Northwest [148], Illinois [133], and Wisconsin [157] indicate that reed canarygrass' growth peaks in mid-June and declines by mid-August. On an experimental site in Ohio, reed canarygrass rhizome production peaked in June and declined through August. Peak rhizome production was associated with a decline in culm production [62,63].

In North America reed canarygrass generally flowers from May through early June but in some locations it may continue to flower into July and August (see Table below). In Iowa [121] and Ohio [63], initiation of the inflorescence may occur in early to mid-April. Flowering may be delayed at latitudes experiencing shorter days. In the greenhouse, plants exposed to more than 12.5 hours of daylight flowered in late May, but flowering was delayed until late June in plants exposed to 12.5 hours of daylight [3].

Dates for reed canarygrass fruit maturation are variable (see Table below). In the Pacific Northwest, reed canarygrass seed matures in late July and early August. In the north-central states, reed canarygrass seed heads usually appear the first week in June, begin to ripen the last week in June, and mature the first week in July [301]. In Wisconsin, reed canarygrass seed maturation and dispersal occur during the latter part of June ([157], review by [119]). In New Jersey, reed canarygrass generally produces seed in early summer [173].

Reported flowering and fruiting periods for reed canarygrass in North America by geographic area

Geographic area	Flowering and/or fruiting periods
California	Flowers: May-Aug [222]
Illinois	Flowers: May-July [214]
Iowa	Spikelets emerged: May 2 [121]
Nebraska	Flowers: July-August [264]
Nevada	Flowers: June-August [142]
North Carolina	Flowers and Fruits: June [241]
North Dakota	Flowers: around June 20th [265]
West Virginia	Flowers: June-July [268]
Wisconsin	Flowers: May through mid-June Fruits: late June (reviews by [119,128])
Blue Ridge Province	Flowers: June-August [308]
Great Plains	Flowers: May-June [87]
North America	Flowers: June-August [64]

Northeast	Flowers: June-August [187]
Pacific Northwest	Flowers: June-July [113] Fruits: late July early August [301]

A 3-year study showed that carbohydrate content of reed canarygrass rhizomes was lowest early in the growing season and increased later in the season. Rhizome carbohydrate content began increasing in mid- to late July and typically continued until mid-November, although in one year carbohydrate accumulations stopped after late August. Rates of carbohydrate storage varied from year to year. Between late July and late August, average rates of carbohydrate accumulation were 0.46 g/g/day the 1st year, 0.15 g/g/day the 2nd year, and 0.12 g/g/day the 3rd year. Researchers could find no explanation for this variability and felt it merited further investigation [1].

After reed canarygrass seed matures and is dispersed, the heads and stem die back to the upper leaves, but the rest of the plant stays green [301]. In the Great Plains, reed canarygrass' panicle may turn brown by midsummer and the lower leaves may die and form a thick mat [294]. A vegetation management guideline indicated that in Wisconsin, reed canarygrass' shoots collapse in mid to late summer, forming a dense, impenetrable mat of stems and leaves [119]. Reed canarygrass may undergo a period of additional growth in the fall ([157], review by [119]). Buds form on the rhizomes in late summer or fall and may develop into flowers on the culms during the next growing season [121]. New shoots develop primarily in the fall and the following spring [63].

REGENERATION PROCESSES:

- **Pollination and breeding system**
- **Seed production**
- **Seed dispersal**
- **Seed banking**
- **Germination**
- **Seedling establishment and plant growth**
- **Vegetative regeneration**

Reed canarygrass spreads within established populations by creeping rhizomes ([80], reviews by [133,184,228,277]) and tillers [46,153,193,219] and colonizes new sites by seed (review by [184]). Ribbon grass may be sterile [14].

Pollination and breeding system: Reed canarygrass produces large quantities of pollen (review by [5]) and is typically cross-pollinated ([75], review by [169]). Merigliano and Lesica [205] indicated that reed canarygrass is wind pollinated.

Seed production: Reed canarygrass seeds used in germination studies had an average length of 4.15 mm [92] and weighed an average of 0.32 [47] to 1.05 mg [92,173]. Reed canarygrass spikelets are 3-flowered; 1 is fertile, the other 2 are sterile [64,83,112,238,298]. Reed canarygrass seed production is highly variable within and between populations [47,172,266,283,301,306]. In a New Jersey wetland, reed canarygrass seed rain counts over a 2-year period ranged from less than 10 to nearly 1,000 seeds/m² [172]. In North Dakota, 1 stem of reed canarygrass produced 120 seeds [266]. In the Pacific Northwest, individual inflorescences produce approximately 600 seeds on average (review by [277]). In the Netherlands, reed canarygrass averaged 393 seeds/flowering shoot [47]. Under cultivation, reed canarygrass yields 30 to 150 pounds of seeds/acre [283,301,306] depending on the strain [306] but may produce as much as 500 pounds/acre [301]. Reed canarygrass seed production may be limited during the first year of growth and increases with increased clone size [146,259].

Because flowering may increase with increased day length [3], reed canarygrass seed production may be greater in latitudes with longer days. In the greenhouse, Allard and Evans [3] found that reed canarygrass flowered more with longer daylight. When reed canarygrass was exposed to 10 to 12 hours of light it produced few decumbent flowers and no stems, only leaves. Flower stem production occurred when daylight increased to 14.5 hours or longer, and more flowers were produced [3].

Seed dispersal: Reed canarygrass seed is passively dispersed [92] by gravity ([47,90,301,306], reviews by [12,119,257]). Seeds ripen from the tip of the panicle downward ([90,301], review by [12]) and are dispersed almost as soon as they ripen ([90,301,306], reviews by [12,119,257]). The ripening period extends over several days [306].

Reed canarygrass seed may maintain buoyancy for a few days after it falls [47], so it may be further dispersed by water ([47], reviews by [119,136]). Reed canarygrass seed has an adhesive quality [288] and may be dispersed by adhering to machines, humans (review by [119]), and other animals ([288], review by [119]). Reed canarygrass seed was found on feet and feathers of waterfowl. Animals may provide long-range seed dispersal of reed canarygrass and help deposit seed in sites more favorable to germination than seed randomly dispersed by water [288]. Ishida [136] indicated that reed canarygrass seed is also dispersed by wind, although details were not provided.

Seed banking: Available evidence suggests that reed canarygrass forms a soil seed bank ([19,72,172,173,240,276], review by [119]), but seed longevity is unclear. In Minnesota, reed canarygrass seedling establishment after control treatments led researchers to conclude that it forms a large seed bank [240]. Leck [173] indicated that reed canarygrass seed remains viable in the soil for more than 1 year. In germination tests, percent germination of reed canarygrass seed declined with increased age. Germination was 87% for 3-month-old seed, 77% for 6-month-old seed, and 65% for 1-year-old seed [92]. A small percentage of reed canarygrass seed remained viable after 20 or more years of burial. Viability was influenced by burial depth; reed canarygrass seeds buried at 22 inches tended to have higher percent germination than those buried at shallower or deeper levels [86,276].

Percentage of reed canarygrass seeds germinating after 1 to 39 years of burial. Seed was originally buried in 1902 [86,276].

Depth buried (inches)	Years buried							
	1	3	6	10	16	21	30	39
8	45	40	30	13	12	5	0	---
22	47	62	53	47	7	12	1	0
42	57	63	38	16	0	1	0	0

Reed canarygrass seed in the soil seed bank may remain viable after periods of inundation [19,199], but seed floating in the water may lose viability relatively quickly [45]. A portion of reed canarygrass seed in the soil seed bank remained viable for at least 56 days of simulated spring flooding [199]. In a marsh in southeastern Wisconsin, reed canarygrass seedlings germinated from soil that had been previously flooded for 3 years [19]. In Washington, 16% of reed canarygrass seeds submerged in a column of water for 3 months germinated, and 7% of seeds submerged for 12 months germinated. No reed canarygrass seed germinated after being submerged in water for 24 months [45].

Reed canarygrass' soil seed bank densities may be high. In a New Jersey tidal wetland, estimated soil seed bank densities ranged from about 100 to over 5000 seeds/m² at a depth of 2 cm [172]. In two reed canarygrass-dominated (75-100% cover) wet meadows in Minnesota, reed canarygrass seed bank densities averaged 475 and 862 seeds/m² [1]. In Wisconsin, seed densities were estimated in 5 wetlands that were dominated by either sedge and reedgrass (meadow) or cattail. At a 5-cm depth, reed canarygrass average seed densities ranged from 0 to 1126 seeds/m² when germinated under wet conditions and 0 to 211 seeds/m² when germinated under flooded conditions [72].

Mean estimated reed canarygrass seed densities in soils of different wetland communities and relative abundance of reed canarygrass in aboveground vegetation [72]

Site	Vegetation	Mean seed density (seeds/m²) at a 5-cm depth estimated by seedling emergence under wet or flooded conditions		Mean relative abundance in aboveground vegetation (%)
		Wet	Flooded	
Oconto	Meadow	0	0	0
	Cattail	282	0	0

Little Sumico	Meadow	1,126	0	0
	Cattail	352	0	0
Long Tail	Meadow	634	211	4.7
	Cattail	0	0	0
Peter's	Meadow	0	0	0.8
	Cattail	0	0	0
Atkinson	Meadow	0	0	0
	Cattail	0	0	0.6

It is unclear how reed canarygrass' aboveground cover influences seed bank densities. In Wisconsin wetlands, estimates of reed canarygrass seed bank density ranged from 211 to 634 seeds/m² on sites where it was most abundant in the aboveground vegetation (4.7% relative abundance). However, average seed bank density estimates were highest (1,126 seeds/m²) on a site where reed canarygrass was not present in the aboveground vegetation [72] (see Table above). In a constructed New Jersey wetland, reed canarygrass seed bank frequency was greatest (67%) where reed canarygrass aboveground frequency was greatest (42%). On 2 other sites where reed canarygrass aboveground frequency was 8%, seed bank frequency was 25% and 50% [174]. In France, reed canarygrass' frequency in an alluvial floodplain meadow under cultivation ranged from 1% to 90%; however, no reed canarygrass germinated from soil samples taken at a 4-inch (10 cm) depth [285].

Germination: Reported germination rates in reed canarygrass are variable [44,92,117,173,178,180,289]. Germination studies, primarily for agricultural purposes, have reported from 3% [44,117,289] to 93% germination [44,92,173,178,180,289] in reed canarygrass under variable light and temperature regimes. Poor curing techniques [90] or genetic variation [289] may contribute to this variability.

Germination rates of reed canarygrass are consistently higher for seed germinated in light than in dark [44,92,117,173,180,289], and several studies indicate that light availability may influence reed canarygrass germination [173,179,180]. In the laboratory, little or no reed canarygrass seed germinated when buried at soil depths of 0.4 and 2 inches (1 and 5 cm), but nearly 100% of the seed germinated when it was transferred to the soil surface [173]. In an experimental wetland, reed canarygrass germination increased on sites where more light penetrated to the soil [179].

Temperature and moisture may influence germination of reed canarygrass seed. A few publications have indicated that exposure to alternating temperatures, rather than constant temperatures, may stimulate reed canarygrass germination [44,165,273]. However, McElgunn [198] observed >90% germination of reed canarygrass at both constant and alternating temperatures.

Percent germination of reed canarygrass seed relative to control (control=100% at constant 21 °C) at various temperature regimes [198]

Temperature regime	% germination
7 °C	94
2 °C/13 °C	46
10 °C	61
4 °C/15 °C	96
13 °C	64
7 °C/18 °C	94
16 °C/27 °C	97

Reed canarygrass seed may germinate better in saturated soils than in dry or flooded soils [22,173]. In the laboratory, germination of reed canarygrass seed planted in saturated soils was higher (~100%) than seed planted in drained or flooded soils (~80%) [173]. Reed canarygrass seed exposed to light had higher germination rates after 30 days when submerged in water (85%) versus seed placed on moist filter paper (66%) [117]. Bonnilla-Warford and Zedler [22] speculated that reed canarygrass seed failed to germinate in pots placed in a controlled environment because the soil was dry.

Reed canarygrass' ability to germinate may be influenced by oxygen availability in the soil [173].

In the greenhouse, reed canarygrass has germinated immediately after ripening ([92,117,173], reviews by [7]), but it is unclear if this commonly occurs in the wild. Kilbride and Paveglio [148] implied that reed canarygrass seed germinates immediately after ripening in the wild, but no evidence was provided. In the greenhouse, fresh reed canarygrass seed germinated within 9 days [92]. In other greenhouse studies, an estimated 3% to 90% of fresh reed canarygrass seed grown in various substrates and temperature regimes germinated within 21 days [44]. Reed canarygrass seed germination rates may improve after undergoing a period of dormancy, at least through the winter. Both dry storage and cold-stratification have enhanced germination in reed canarygrass to a limited extent [117,289]. Germination rates for fresh reed canarygrass seed were lower (9-16%) than for seed that germinated the following growing season (34-85%) after undergoing cold-stratification [117]. Vose [289] described germination for various strains of reed canarygrass to be "poor and irregular" and attributed it to seed dormancy. In the laboratory, scarification may break reed canarygrass seed dormancy and increase germination; however, freshly scarified seed sown in soil may not germinate after 2 or 3 days [289].

Seedling establishment and plant growth: Seedling establishment may be most common on moist open sites (review by [76]) such as mud flats [157], seasonal floodplains [153], and reservoir shores [117]. Reed canarygrass seedlings generally emerge within 8 to 10 days from seed planted in spring [45,63]. In a tidal wetland in New Jersey, seedling counts ranged from about 80 to nearly 120 seedings/m² [172]. Under cultivation, spring seedlings grow 10 to 20 inches (30-50 cm) tall [301] and may spread 6 to 10 inches (15-25 cm) in diameter within the first year [306].

Once established, reed canarygrass seedlings undergo rapid development ([46,301,306], review by [7,148]) from rhizomes ([46], review by [148]) and tillers [46], provided suitable substrate and moisture are available ([117,157], review by [76]). In an experimental field, tillering began within 1 month after seedlings emerged, and average tiller production increased from 0.5 tiller/seedling during the 1st month of growth, to 5.5 tillers/seedling after 10 weeks [46].

Under cultivation, different strains of reed canarygrass vary greatly in vigor of growth [306]. Wild populations likely share the same variability because they are thought to be an assemblage of introduced strains (see Native Status in North America). Results from several studies suggests that reed canarygrass can grow rapidly once it has established [62,157,204,294]. One review indicated that reed canarygrass grows most rapidly during the cool spring months [283]. In a Wisconsin marsh, reed canarygrass grew throughout the growing season but its maximum growth occurred from 26 April to 10 June [157]. Reed canarygrass shoots emerging in spring in a Missouri floodplain generally reach a foot high in April and up to 3.5 feet (1.1 m) tall by July [294]. Reed canarygrass may reach 4 to 5 feet (1-2 m) tall within 2 to 4 years [204,301] and may grow more rapidly on open than shaded sites (see Shade tolerance).

Under experimental conditions, increases in nitrogen and phosphorus concentrations typically have a positive influence on reed canarygrass biomass [20,67,108,146,147,193,300] and tiller production [193,196] and may have similar influences in wetlands [193]. Plant survival rates, however, may not improve with increased nutrients [67].

Several studies have documented increases in reed canarygrass' aboveground growth with increased flood duration [108,146,209], and one study found that submerged reed canarygrass maintains its photosynthetic capabilities for at least short periods of flooding [286]. Conversely, reed canarygrass growth may be adversely impacted by extended periods of flooding [26,47] or anoxia [13]. One study from western Europe indicated that reed canarygrass' growth may be adversely impacted by extended periods of drought [139].

Vegetative regeneration: Within the first year of growth, reed canarygrass produces rhizomes and begins tillering [62,219]. In the greenhouse, reed canarygrass seedlings formed rhizomes before the plants were 2 months old and produced tillers soon after [219]. Mature reed canarygrass plants spread rapidly by rhizomes (Klimesova and Cizkova 1996 cited in [228]). Up to 74% of new shoots may originate from rhizomes; the remainder develop from buds located in the leaf axils of aboveground shoots [63]. In the greenhouse, transplanted rhizomes branched up to 7 times in one year [62]. In Europe, 3 to 5 generations of tillers were produced by 1 reed canarygrass plant in 1 year. Occasionally culms became inclined, and if the topsoil was moist, they rooted at the nodes and produced new upright stems [219]. Flooding may reduce rhizome growth [153,209] and tiller production ([153], review by [251]), particularly if it occurs in the summer [153]. Shade may also have an adverse affect on rhizome survival [196].

Reed canarygrass rhizome fragments sprout in controlled environments [22,196] and likely do so in the wild. Reed canarygrass abundance in a monotypic stand was reduced 1 year after soil scarification, but plants continued to sprout from rhizome fragments [148]. Reed canarygrass regrows following cutting, mowing, or other types of damage ([82,148,161,260,301], review by [251]) probably from its rhizomes and possibly from its root crown.

SITE CHARACTERISTICS:

Climate: Reed canarygrass is a circumboreal, cool-season grass [88,119] and is most productive in the spring and fall during periods of cool temperatures and plentiful moisture [32]. Reed canarygrass is considered winter-hardy [283], although different strains may be less adapted to cold than others. European strains may survive colder temperatures than some North American strains [152]. Reed canarygrass' net photosynthesis is maximized at temperatures of about 68 °F (20 °C) and reduced to 80% of maximum at 100 °F (38 °C), suggesting it may not perform well in subtropical or tropical climates [190].

A few localized examples illustrate that reed canarygrass tolerates a wide range of temperature and precipitation regimes. In North America, reed canarygrass occurs in areas where average annual low temperatures range from 9.5 °F (-12.5 °C) [216] to 40.5 °F (4.7 °C) [69,182] in the coldest month, and average annual high temperatures range from 59.2 °F (15.1 °C) [182] to 70 °F (21 °C) [69,216,284] in the warmest month. Reported average annual precipitation on sites where reed canarygrass occurs range from 18 inches (450 mm) [284] to 80 inches (2,000 mm) [41,127,182,216,264,284]. In North America, reed canarygrass occurs in locations where the majority of rainfall occurs seasonally [41,69,182,264,284] but the time of the year is variable.

Elevation: Information pertaining to reed canarygrass' North American elevational range comes from local floras or is anecdotal. Reed canarygrass tends to occur at low to middle elevations but occasionally occurs at high elevations. The following table may not reflect reed canarygrass' complete elevational range in North America.

Reported elevations for reed canarygrass in North America	
Geographic area	Elevation
Arizona - Crater Lake	8,000 feet [143]
California	below 5,000 feet [222]; below 5,200 feet [111]
Colorado	4,500 to 9,000 feet [99]; lower valleys [295]
Idaho	3,400 to 5,600 feet [94]
Nevada	4,000 to 8,000 feet [142]
New Mexico	5,500 to 7,500 feet [220]
Oregon - Cascade Mountain Range	more common below 4,000 feet than above [197]
Tennessee	2,700 to 2,900 feet (planted) [69]
Utah	4,230 to 9,006 feet [298]
Washington	occurs at low to moderate elevations [159]
New England	1 to 1,900 feet; 1 observation made at 3,200 feet [201]
Pacific Northwest	low to middle elevations [238]
Quebec	~ 98 feet [81]

Substrate and water chemistry: In North America, reed canarygrass occurs on a variety of soil textures from clay to sand [34,64,94,97,202,220,264]. In wetlands of the northcentral United States and the Great Lakes area, reed canarygrass commonly occurs in muck [23,51,95,189,220] and peat [11,23,51,73,206,307,310] deposits of varying mineral and organic content. A few reports indicate that reed canarygrass occurs in mineral soils [34,244] and muck [244,250] in the Northeast.

Riparian plant community publications from Idaho [6] and Montana [97] and studies from Wisconsin [157] and Ohio [206] indicate that reed canarygrass tolerates pH ranging from 6.0 to 8.1 in wetlands and riparian areas. In Tennessee, reed canarygrass was planted and survived on a site with soil pH as low as 5 [69]. In Alberta, Canada, reed canarygrass occurred in oxbow lakes with water pH ranging from 8.4 to 8.8, but in one oxbow, pH fluctuated between 7.5 and 10 [284].

Reed canarygrass may tolerate mildly saline water [140] but is intolerant of hypersaline conditions [200].

Moisture: Reed canarygrass prefers sites with moist to saturated soils [97,111,140,142,143,160,244,250,271,283,294]. Reed canarygrass has a wetland indicator status of "Obligate" (~99% probability of occurring in a wetland) in Alaska, California, the Southeast, Southwest, and Intermountain regions of the United States. Throughout its remaining United States distribution, it has a wetland indictor status of "Facultative Wetland" (67-99% probability of occurring in a wetland) [282]. Reed canarygrass tolerates flooding [32,190,204,220,257,277,301] and may prefer sites that experience periodic flooding [41,51,156,164,203,220,244,284,301], but for how long is unclear. Reports from northwestern states indicate that reed canarygrass may survive flooding lasting from weeks [204] to months [301], and up to 1 year if it is not totally submerged (review by [277]). In Canada, reed canarygrass seedlings survived periods of flooding lasting from 35 to 49 days [199]. In South Dakota, planted reed canarygrass seedlings inundated for up to 9 weeks survived and spread. Their cover was temporarily reduced when inundation lasted for more than 6 weeks, but they recovered before the next flood season [118]. In California, reed canarygrass established after being seeded in December but failed to survive 61 days of flooding on an experimental site [100]. In New Mexico, reed canarygrass tolerates anaerobic conditions [220]. Flooding has been recommended for reed canarygrass control in some situations, which suggests that reed canarygrass may not tolerate prolonged flooding in all circumstances.

Several publications suggest that reed canarygrass is drought tolerant [76,190,277,283,306], while others suggest it has little drought tolerance [204]. A publication from the Nature Conservancy indicated that in the Pacific Northwest, reed canarygrass tolerates "prolonged" periods of drought [277]. Conversely, Merigliano [204] considered reed canarygrass to have a "very low" tolerance to drought in riparian areas along the South Fork Snake River in Idaho. One laboratory study [139] indicated that reed canarygrass growth may be adversely impacted by drought (see Seedling establishment and plant growth). Statements made regarding reed canarygrass' tolerance to drought often come from agronomic sources [190,283,306] and are sometimes made in reference to other cultivated or upland grasses [76,190,306], so they are difficult to apply to wildland conditions. Reed canarygrass drought tolerance may differ among its numerous strains and cultivars [306].

General habitat: In North America, reed canarygrass occurs in marshes, wet meadows and prairies, lake shores, stream banks [9,15,87,131,142,158,187,195,241,250,252], and river islands [15,243,293]. Stream surveys from 12 western states indicate that reed canarygrass is significantly (*P*<0.001) more common along large streams than small [248]. Reed canarygrass also occurs in fens and bogs, particularly in the Rocky Mountains [252] and Great Lakes states [51,178,195]. In the Great Plains, it is common in prairie potholes, particularly those located in fallow and hayed fields [140]. Along the east coast it occurs in freshwater tidal marshes [34,67,173,229]. Throughout its North American range, reed canarygrass occurs in riparian forests [53,54,66,293], and in the northwestern and Great Lakes states, reed canarygrass may invade upland sites such as oak savannas [6,106,119,202] or upslope drainage seepages [57]. In Ohio, it occurred in a forested bog [206].

Reed canarygrass is common on anthropogenically altered sites such as ditches [87,238,295], agricultural fields that are under cultivation or abandoned [40,103,238,239], sites near water impoundment structures (e.g., dams, levees) [175,248], disturbed wetlands [11,109], and along highways [113] and roads [238]. It also establishes on sites where natural disturbance has occurred, such as flooding and wildfire (see Potential successional stages).

Although disturbance may facilitate reed canarygrass establishment, it is not a requirement [11,119,167,175,188]. In northwestern Oregon, reed canarygrass occurred in 89 of 93 wetlands surveyed; 45 were naturally occurring wetlands, and the remainder were disturbed and/or constructed wetlands [188]. In one study from Manitoba, Canada, reed canarygrass occurrence was negatively associated with disturbance and positively associated with plant diversity [213].

SUCCESSIONAL STATUS:
Various factors make it difficult to define reed canarygrass' successional role. Sites where reed canarygrass is most common such as wetlands, floodplains, and abandoned farm fields (see Habitat Types and Plant Communities) may not have clear patterns of succession. Many natural and anthropogenic factors influence floodplain succession, including flooding, wildfire, windthrow, timber harvest, flow alteration, ungulate browsing, invasion by nonnatives, and disease (review by [93]); this complexity makes it difficult to define successional stages or predict successional changes in these ecosystems. Because water level typically fluctuates in wetlands [120,228], vegetation changes in wetlands are often cyclic [120,228,284]; neither "true" primary nor typical secondary succession is likely to occur in wetlands (review by [228]). Additionally, some evidence suggests that dense, tall stands of reed canarygrass may themselves influence successional pathways, further complicating its successional role.

Shade tolerance: Reed canarygrass prefers full sunlight ([196], reviews by [119,204]) and, while it grows in shade ([66,202], reviews by [119,215]), its abundance may decrease with decreased light. In Washington, reed canarygrass biomass was reduced by 68% within 2 years after willow plantings and subsequent canopy development [149]. Based on reed canarygrass' frequency in floodplains of the Mississippi and Wisconsin rivers, Menges and Waller [203] concluded that reed canarygrass had a preference for well-lit sites. In the greenhouse, reed canarygrass' aboveground biomass was reduced in shade when compared to reed canarygrass grown without shade. In heavy shade (86% shade), reed canarygrass' aboveground biomass was reduced by 97% compared to plants grown without shade [196].

Reed canarygrass' rhizomes and tillers may allow it to spread and persist in heavily shaded areas. In a greenhouse, shade did not significantly (P=0.0832) affect tiller production when compared to plants grown without shade [196], especially for tillers attached to parent clones growing in sunlight (review by [195]). However, tiller shoot biomass was significantly (P=0.0063) lower in shaded plants, and rhizome survival was reduced by 25% in heavy shade (86%) [196]. Under experimental conditions, reed canarygrass rhizome fragments sprouted under approximately 30% plant cover [22].

Germination and seedling establishment in reed canarygrass improve with increased light levels; however, reed canarygrass seedlings may establish in shade. In the greenhouse, reed canarygrass seedling densities did not differ in variable light levels (i.e., full sun, partial shade, and full shade) [236]. However, in an experimental wetland in Minnesota, seedling establishment was reduced by 87% when light levels were decreased by up to 96% [134]. Leck [172] suggested that seedlings could establish in shaded habitats during the summer or fall under canopy gaps created when leaf cover declines.

Potential successional stages: Available evidence indicates that reed canarygrass establishes, persists and may spread in plant communities of various successional stages, from early [18,66,71,79,156,204,207,228,239] to late succession [66,93,144]. It occasionally occurs as a transient species in early succession [307] but typically persists longer [66,71,221,228].

Reed canarygrass establishes on anthropogenically disturbed sites (see General habitat) and on sites in early stages of secondary succession where the vegetation cover has been altered or removed by natural disturbance. Reed canarygrass establishes in recently abandoned farmlands in the early stages of succession ([18,79], review by [239]). It also establishes in floodplains where bottomland vegetation has been scoured by flooding [71], in recently constructed or restored wetlands [175,221], on lakeshores undergoing drawdown [228], on newly created gravel bars [15,204], and shortly after fire (see Plant response to fire).

In some instances reed canarygrass may be transient and disappear after early succession. In Wisconsin, Kopatek [157] considered reed canarygrass a transient species. In northwestern Montana, a trace amount (0.5% average cover) of reed canarygrass was found in a sedge meadow 1 year following wildfire but was not observed again during the remainder of the 3-year study [307].

Typically, reed canarygrass persists and spreads in mid- to late succession [66,71,221,228]. In the Great Plains, reed canarygrass invaded 80% of restored prairie potholes (n=41) within 10 years after restoration efforts were completed and was the dominant shoreline vegetation in nearly 50% [221]. In Norway, reed canarygrass was initially uncommon on a lakeshore undergoing permanent drawdown; however, it became increasingly dominant over a 12-year period [228]. Reed canarygrass germinates better in light than shade, and reports of its establishment in later succession are limited to a field study from Great Britain: reed canarygrass established in a previously cultivated wet grassland undergoing secondary succession on a site where it had not previously occurred for 35 years [25].

Several studies indicate that reed canarygrass reaches its greatest abundance in early to mid-succession and declines thereafter [66,71,120,228]. This may be especially true on sites where reed canarygrass is not the dominant vegetation [71,120] or where it becomes shaded [66]. In Oregon, reed canarygrass dominated the ground vegetation (based on relative frequency and cover) in riparian forests from 1 to >65 years old; however, it was most common in 4- to 7-year-old stands [66]. In Colorado, reed canarygrass established in a riparian area after a major flood event. It reached maximum frequency (31%) approximately 20 years after the flood and declined sharply (to 7%) during the next 5 years [71]. Reed canarygrass occurred in an oxbow that had been previously disturbed by human activities. Reed canarygrass was uncommon (cover<0.5%; frequency = 2%) on the site approximately 12 years after disturbance had ceased and no longer occurred after another 10 years [120].

In some instances, reed canarygrass' abundance may remain relatively stable for long periods, especially in the absence of disturbance. In Wisconsin, reed canarygrass occasionally occurred (6.1% frequency, 9.7% cover) in a bog that had remained relatively undisturbed. Fifteen years later its frequency had increased by 3% and its cover by less than 1% [211].

Over time, reed canarygrass may displace other wetland plants and eventually dominate the vegetation. In Oregon, reed canarygrass may eventually displace a Columbian sedge community type and form near-monotypic stands [197]. On a lakeshore in Norway undergoing permanent drawdown, reed canarygrass became increasingly dominant, establishing dense populations in areas previously dominated by spikerush (*Equisetum* spp.) and sedges [228]. Dense stands of reed canarygrass may influence succession by preventing the establishment of woody species [48,65,174,204]. For example, along the Allegheny River in Pennsylvania, reed canarygrass dominated the vegetation and precluded forest development on sites that had been logged about 66 to 126 years earlier [48].

FIRE EFFECTS AND MANAGEMENT

SPECIES: Phalaris arundinacea

- FIRE EFFECTS
- FUELS AND FIRE REGIMES
- FIRE MANAGEMENT CONSIDERATIONS

FIRE EFFECTS:

- **Immediate fire effect on plant**
- **Postfire regeneration strategy**
- **Fire adaptations**
- **Plant response to fire**

Reed canarygrass is top-killed by fire. In near-monocultures of reed canarygrass

Immediate fire effect on plant:

(>80% relative cover) in Wisconsin, 100% of the aboveground vegetation was top-killed by May burns, and 97% to 100% was top-killed by August burns [129].

Reed canarygrass rhizomes likely survive most low- to moderate-severity fires but may be killed by high-severity fires in some plant communities. Studies and observations indicate that reed canarygrass sprouts after fire (see Fire adaptations and Plant response to fire), suggesting that its rhizomes likely survive fire if they are buried deep enough in the soil (see Botanical description) to be protected from lethal heating ([39], reviews by [208,302]). Reed canarygrass sometimes occurs in wetlands with deep organic soils (see Habitat types and plant communities). When these sites are drained or experience severe drought, severe ground fires, such as those described by Curtis [51] in sedge meadows in Wisconsin, may smolder for long durations and consume organic surface layers, burning down to the underlying mineral soil or parent material [51,73,74,307]. Reed canarygrass rhizomes occurring in organic layers would be killed in these circumstances.

Studies in which reed canarygrass seedlings were observed after fire [1,69] indicate that reed canarygrass seeds in the soil seed bank survive fire and that germination may be stimulateded by fire or by postfire conditions. Less than 1 month after early spring controlled burns in monotypic stands of reed canarygrass in a wetland in northeastern Tennessee, reed canarygrass seedlings were growing from gaps in the litter on burned plots [69]. In Minnesota wet meadows undergoing restoration treatments, reed canarygrass' seeds survived and germinated "immediately" after spring prescribed fires that were described as being comparable to a "high-intensity grassland fire" [1]. No additional information was available (as of 2010) regarding how fire intensity and severity influence reed canarygrass seed survival.

Postfire regeneration strategy [267]:

Surface rhizome and/or a chamaephytic root crown in organic soil
Ground residual colonizer (on site, initial community
Initial off-site colonizer (off site, initial community)
Secondary colonizer (on- or off-site seed sources)

Fire adaptations: Reed canarygrass establishes rapidly after fire on sites where it occurs in the prefire plant community (see Plant response to fire), suggesting that it is adapted to survive and regenerate after fire. Few studies describe fire characteristics or indicate whether postfire establishment of reed canarygrass is from sprouting or seed germination.

Postfire sprouting from surviving rhizomes and/or root crowns may allow reed canarygrass to regain prefire density and biomass shortly after fire. Reed canarygrass rhizomes likely survive fire under most conditions, with the exception of those exposed to severe ground fires that may occur in organic soils (see Immediate fire effect on plant). In an Oregon wetland, reed canarygrass tiller density increased within 2 years following prescribed fire; however, no information was given on fire frequency, severity, or substrate characteristics associated with this study [279]. In Minnesota, reed canarygrass biomass was similar in burned and unburned plots (200-300 g/m²) 12 weeks after a "high-intensity" prescribed fire [1].

Studies from Minnesota [1] and Tennessee [69] indicate that reed canarygrass establishes from residual seed banks after fire. It may also establish from off-site seed sources (see Seed dispersal). Researchers [1,240] have speculated that fire creates optimal germination conditions for reed canarygrass by improving light availability. At the time of this writing (2010), no information was available on characteristics that enable reed canarygrass seed to survive fire.

Plant response to fire: Established reed canarygrass typically persists [1,69,105,260] and may increase in abundance [1,105,200,279] after fire, and fire may stimulate reed canarygrass seed germination [1,69]. None of the literature reviewed described postfire mortality of established reed canarygrass. Reed canarygrass' response to fire may be influenced by timing of fire and plant phenology, fire intensity and/or severity, presence and abundance of fire-tolerant native plants, and other ecological processes. When fire is used as part of an integrated management plan, reed canarygrass' response to fire may be influenced by the timing and sequence of other treatments (see Use of prescribed fire as a control agent).

Postfire persistence and spread: On sites where reed canarygrass is well established, it may persist and grow rapidly after fire [1,69,260,279], and in some instances it may spread [105]. In a monotypic stand of reed canarygrass in Tennessee, there was no significant (P>0.05) difference in live reed canarygrass root or shoot biomass for burned and unburned plots approximately 5 and 17 months after a spring (March) prescribed fire [69]. In a monotypic stand of reed canarygrass on a site that was historically sedge meadow and wet prairie in northeastern Illinois, reed canarygrass persisted after a low-severity prescribed fire in early March and was 6 to 12 inches (15-30 cm) tall by early May [260]. In a "large" stand of reed canarygrass in Oregon, tiller production was greater in plots after they were burned than before [279]. In a near-monotypic stand of reed canarygrass in Minnesota, reed canarygrass' shoot density was higher in burned plots (1,180 shoots/m²) compared to control plots (520 shoots/m²) 4 weeks after prescribed fire; however, by the 12th week overall biomass was similar in burned and unburned plots [1]. Where reed canarygrass was invading an oak savanna in Wisconsin, early spring fire appears to have "accelerated its spread" [105]; however, late spring burning had negative impacts on reed canarygrass.

Reed canarygrass may not always persist after fire. In a 3 year study, a small patch (0.5%) of reed canarygrass was found the 1st year after a mixed-severity wildfire in a wet sedge meadow in northwestern Montana, but it failed to persist beyond the 1st postfire year. No information was provided regarding the abundance of reed canarygrass either before the fire or in unburned areas. Beaked sedge dominated both the burned and unburned areas in the 3 years after the fire [307].

Reed canarygrass' rapid postfire establishment from the soil seed bank [1,69] suggests that postfire conditions may favor its germination. In a reed canarygrass field in Tennessee where seasonal flooding had recently been restored, reed canarygrass seedlings established within 1 month after prescribed fire [69]. On sites dominated by reed canarygrass in Minnesota, reed canarygrass seed density in the soil after a low-severity spring prescribed fire was significantly (P=0.03) less than in unburned plots. Researchers attributed the difference to germination of reed canarygrass seeds immediately after fire [1], although preburn seed densities were not reported for either burned or unburned plots.

Influence of fire frequency on plant response to fire: As of this writing (2010), little information is available on the effects of fire frequency on reed canarygrass. Vegetation management publications recommend late spring or late fall prescribed fire repeated annually for 5 to 6 years to reduce reed canarygrass abundance [119,133,263] but provide no examples to support this recommendation. Reed canarygrass may persist after repeated fires, especially where it is a dominant or codominant species. Nearly monotypic stands of reed canarygrass persisted after 3 consecutive years of spring prescribed fires in an eastern Tennessee wetland [69]. In Wisconsin, reed canarygrass was a codominant species in a wet-mesic prairie that had been burned for 30 years on at least a biennial basis. While it is unclear when reed canarygrass established on the site, its relative dominance in the plant community suggests its invasion was not recent [42]. Frequent prescribed fires may be effective for controlling reed canarygrass in plant communities where desired, fire-adapted species dominate the plant community or seed bank (reviews by [119,133]) (see Use of prescribed fire as a control agent).

Influence of fire season on plant response to fire: The effects of fire season on reed canarygrass vary and probably depend on interactions with other variables such as plant community associates, fire frequency, and fire timing relative to plant phenology.

Howe [126,127,129] has conducted the only studies to date (2010) that investigate differential effects of fire season without other, confounding treatments. This research indicates reed canarygrass may be reduced by spring burning and increased by summer burning, but summer burning is unlikely to favor reed canarygrass to the point where it becomes dominant in areas previously dominated by warm-season grasses. Details of Howe's studies are described in the research project summary, Herbaceous responses to seasonal burning in experimental tallgrass prairie plots.

The first of Howe's studies [126,127] investigated the seasonal effects of fire in agricultural fields where vegetation was removed and tallgrass prairie species planted. Reed canarygrass was not one of the species planted but, within 3 years, was among the 12 most common species on the site. In the 4th year, one-third of the plots were burned in spring, one-third were burned in summer, and the remaining one-third were left unburned. The following year, reed canarygrass cover and frequency did not differ significantly among treatments [126]. Three years later, the same experimental plots were burned in the same seasons. The following year, mean reed canarygrass cover in summer-burned plots (18.6%) was significantly greater than in either spring-burned (1.5%) or unburned (3.5%) plots [127]. The summer after the second burn, warm-season plants dominated all plots regardless of treatments but were less abundant in plots burned in the summer than those burned in the spring or not burned at all. In contrast, cool-season plants, including reed canarygrass, were reduced in spring-burned and unburned plots but increased in summer-burned plots, although they did not become dominant. Howe [127] concluded that summer burns in this plant community reduced abundance of warm-season plants, allowing cool-season plants, such as reed canarygrass, to persist and even “prosper” [127].

A second study in the same area [129] described abundance of red canarygrass relative to that of other cool-season grasses and 3 warm-season grasses. Experimental plots were cleared of previous vegetation, then seeded with reed canarygrass and 2 other cool-season grasses (slender wheatgrass (*Elymus trachycaulus*) and Virginia wildrye (*Elymus virginicus*)); and 3 warm-season grasses (big bluestem (*Andropogon gerardii*), switchgrass (*Panicum virgatum*) and prairie dropseed (*Sporobolus heterolepis*)). Within 2 years of seeding, plots had become a near monoculture (97% relative cover) of reed canarygrass. Six plots were burned in May 1995 and again in May 1997; 6 were burned in August 1995 and again in August 1997; and 6 plots were left unburned. After the second burns, 2 warm-season species, big bluestem and switchgrass, increased in dominance in spring-burned plots while reed canarygrass, a cool-season species, decreased. In summer-burned plots, reed canarygrass was expected to increase substantially. Instead it codominated with the other 2 cool-season grasses (Virginia rye and Kentucky bluegrass) and the warm-season grasses [129].

In an oak savanna in Wisconsin, an early April prescribed fire did not control reed canarygrass and may have accelerated its spread. Late spring burning (mid-to-late May) weakened reed canarygrass and prevented it from producing seed but was also detrimental to some of the desired native plant species [105].

Influence of flooding on plant response to fire: Effects of fire on reed canarygrass may be influenced by flooding. In northern California, reed canarygrass was a subdominant species in wetlands that were dominated by quackgrass (*Elymus repens*) or saltgrass (*Distichlis spicata*). Wetlands were burned in December 1990 and again in November 1991 to study the effects of prescribed fire on plant species diversity, plant community composition and plant community use by wild geese. Fire had little effect on reed canarygrass relative abundance in the saltgrass community. In the quackgrass community, reed canarygrass relative abundance increased after both fires; however, it was less abundant in burned blocks than expected in the year when spring flooding was "extensive". The authors recommended further study of the interactive effects of burning and flooding on reed canarygrass abundance [200].

FUELS AND FIRE REGIMES:

- **Fuels**
- **Fire regimes**

Fuels: Although several studies report on the use of fire to manage reed canarygrass, as of this writing (2010), little has been reported on its fuel characteristics. Wetland fires may be difficult to conduct in monotypic stands of reed canarygrass because it remains green into the fall (reviews by [119,277]). High water levels may also limit burning in wetlands ([97], review by [119]). Wade and others [291] described fuel characteristics for coastal marshes in the eastern United States although they do not address reed canarygrass specifically. In general, these ecosystems support abundant fine fuels and large quantities of herbaceous vegetation that is often "highly" flammable [291].

As mature reed canarygrass plants senesce late in the season, litter accumulates and forms thick, impenetrable mats [119,294]. Fire may be used to reduce this litter ([69,305], review by [277]), even when standing reed canarygrass is green. In near-monocultures of reed canarygrass (>80% relative cover) in an experimental field in Wisconsin, litter comprised more than 80% of total biomass in unburned plots in May but less than half of total biomass in unburned plots in August. Fire behavior was more variable on August-burned plots in this sutdy than on May-burned plots. The year after a single burn, productivity did not differ significantly between May-burned, August-burned, and unburned plots. However, the year after a second burn, productivity was greatest on spring-burned plots, less on summer-burned plots, and least on unburned plots ($P<0.05$) [129]. In a dense stand of reed canarygrass in Minnesota, researchers did not get a "good burn" during a June prescribed fire, which they attributed to the high moisture content of the litter [240].

Reed canarygrass may produce wind-borne embers when stands are burned (Eggers personal communication 1997 cited in [249]).

Fire regimes: Because reed canarygrass' native status in North America is unclear, its relationship to historic fire regimes in plant communities where it occurs is unknown. Reed canarygrass typically occurs in wetlands and riparian areas. Fire is important to the maintenance and development of some wetland communities [77,233,297]. Wetland plant communities have varying moisture regimes and fuel characteristics, so fires in these ecosystems vary in frequency and intensity; some, such as marshes, may burn frequently; others, such as forested wetlands, seldom burn [183]. In eastern coastal marshes, grasses in general burn more readily and usually support much more intense and continuous fires than forb- or sedge-dominated plant communities [291]. Of special interest are peatlands where reed canarygrass occurs. Peatlands in Wisconsin have been known to burn in excess of 2 years [51].

Few studies have investigated the behavior, properties, and influence of wildfire in riparian areas. Riparian forests generally have more available moisture and may differ in understory vegetation, fuel loads, and fuel moisture from adjacent uplands. In these communities, especially in moist forest types, fire typically has longer return intervals and is less severe than in adjacent uplands [61].

Reed canarygrass may persist with frequent fire. In Wisconsin, reed canarygrass was a codominant species in a wet-mesic prairie that had been burned for 30 years on at least a biennial basis. While it is unclear when reed canarygrass established on this site, its relative dominance in the plant community suggests its invasion was not recent [42].

Reed canarygrass may establish on sites where fire is reintroduced after having been excluded for years. In northern Illinois, reed canarygrass established in mesic prairies when fire was reintroduced after being excluded for at least 22 years (1978-1998). Reed canarygrass was not recorded on these sites in 1976 or 1998. However, in 2003, 5 years after fire was reintroduced, reed canarygrass occurred in 10% of plots in dry-mesic gravel prairie and in 20% of plots in mesic gravel prairie [24]. The authors did not indicate whether reed canarygrass propagules came from residual or off-site sources.

Because reed canarygrass is a cool-season grass, spring fires that prevent its flowering may limit its spread (see Plant response to fire).

See the Fire Regime Table for further information on fire regimes of vegetation communities in which reed canarygrass may occur. Because fire regimes in wetlands and riparian areas may be closely related to fire regimes in adjacent upland communities, readers may want to review the complete FEIS Fire Regime Table.

FIRE MANAGEMENT CONSIDERATIONS:

Several publications discuss the use of fire [1,200,260] or recommend prescribed fire (reviews by [5,6,110,119,133,263]) to manage reed canarygrass. However, reed canarygrass' adaptations to fire indicate that fire alone is not likely to control reed canarygrass (see Fire adaptations and Plant response to fire). Fire may help control reed canarygrass when used as part of an integrated management plan (see Use of prescribed fire).

Many factors complicate the use of fire to manage reed canarygrass. High temperatures required at the soil surface to burn through the reed canarygrass sod layer may be difficult to achieve in wetlands (review by [6]) and a fire of this severity may also kill desired native wetland plants [51]. Because monotypic stands of reed canarygrass may produce windborne embers, firebreaks may need to be wider than those typically used for upland fires (Eggers personal communication 1997 cited in [249]). However, dense stands of vegetation, like monotypic stands of reed canarygrass, may make the creation of firebreaks more difficult (review by [249]).

When considering fire as a treatment option for reed canarygrass, managers should be aware of its potential for postfire establishment and spread (see Plant response to fire). Reviews caution that fire may not control dense monocultures of reed canarygrass [133], especially where there are no fire-adapted native wetland species in the seed bank [133,168], unless native species are seeded [168]. The postfire recovery of native wetland communities in stands of reed canarygrass should be carefully monitored [168]. For generalized information about the use of prescribed fire in wetlands and related management considerations see Robertson [249].

Preventing postfire establishment and spread: Preventing invasive plants from establishing in weed-free burned areas is the most effective and least costly management method. This may be accomplished through early detection and eradication, careful monitoring and follow-up, and limiting dispersal of invasive plant seed into burned areas. Reed canarygrass has been used for revegetating bulldozer-constructed firelines [21] and has been recommended for use to revegetate recently burned sites [261]. These practices should be avoided to reduce its spread on wildlands.

General recommendations for preventing postfire establishment and spread of invasive plants include:

- Incorporate cost of weed prevention and management into fire rehabilitation plans
- Acquire restoration funding
- Include weed prevention education in fire training
- Minimize soil disturbance and vegetation removal during fire suppression and rehabilitation activities
- Minimize the use of retardants that may alter soil nutrient availability, such as those containing nitrogen and phosphorus
- Avoid areas dominated by high priority invasive plants when locating firelines, monitoring camps, staging areas, and helibases
- Clean equipment and vehicles prior to entering burned areas
- Regulate or prevent human and livestock entry into burned areas until desirable site vegetation has recovered sufficiently to resist invasion by undesirable vegetation
- Monitor burned areas and areas of significant disturbance or traffic from management activity
- Detect weeds early and eradicate before vegetative spread and/or seed dispersal
- Eradicate small patches and contain or control large infestations within or adjacent to the burned area
- Reestablish vegetation on bare ground as soon as possible
- Avoid use of fertilizers in postfire rehabilitation and restoration
- Use only certified weed-free seed mixes when revegetation is necessary

For more detailed information on these topics see the following publications: [10,28,85,281].

Use of prescribed fire as a control agent: As of this writing (2010), there is little information on the effects of prescribed fire alone on reed canarygrass with the exception of a few studies of the effects of varying fire seasons (see Plant response to fire). Most information pertaining to prescribed fire for control of reed canarygrass comes from studies of integrated treatments [1,69,123,240,260,279,305]. Prescribed fire may reduce reed canarygrass litter ([69,305], review by [277]) or aboveground biomass [1,69,123,279] so that other treatments may be more effective. Fire may be effective on sites where fire-adapted native species are present in the plant community or seed bank [133,260], or where these are planted as part of the treatment. Fire preceded by herbicide treatment may improve survival of planted woody species in monotypic stands of reed canarygrass [123] (see Integrated treatment considerations).

Integrated treatment considerations: Integrated treatments incorporating prescribed fire for reed canarygrass control typically include some combination of prescribed fire and herbicide followed by seeding or planting of desired native species. Fire timing may influence the outcome of reed canarygrass control treatments [168]. Most studies evaluating integrated treatment options use spring [1,69,260,305] or early summer [240] fires. In one instance, late-season prescribed fire was used to reduce litter accumulation created from a previous fire and herbicide treatment [305]. Researchers in Minnesota [1] speculated that repeated prescribed fires to encourage reed canarygrass germination, followed by herbicide application to kill seedlings, may deplete the seed bank and thus limit reed canarygrass' potential to reinvade sites undergoing restoration. One study from Wisconsin used mowing, herbicide, then prescribed fire to suppress reed canarygrass growth [123]. Following are descriptions of five studies in which prescribed fire was integrated with other techniques in attempts to control reed canarygrass.

Two studies have evaluated sethoxydim—a grass-specific herbicide— in conjunction with other treatments to control reed canarygrass [260,305]. Researchers in Illinois used sethoxydim in conjunction with with prescribed fire, glyphosate application, and native plant seeding to control a monotypic stand of reed canarygrass [260]. In 2006, an early March prescribed fire was followed by a 10 May application of glyphosate. A second fire was conducted on 8 June 2006 to reduce thatch left unburned by the March fire. Then the site was seeded with a native sedge and forb mix. Sethoxydim was applied on 15 August 2006, when reed canarygrass was about 15 cm tall, and again on 18 May 2007. Plots were burned again on 18 April 2008, and sethoxydim was applied on 6 May 2008. In late July 2008, control plots averaged 88.3% reed canarygrass cover and 9.5% native graminoid cover, while treated plots averaged 14.4% reed canarygrass cover and 86.7% native graminoid cover. The author anticipates that regular prescribed fire and spot applications of glyphosate to reed canarygrass clumps will maintain the planted native sedge meadow [260].

Another study also observed improved native plant establishment when sethoxydim was applied after a combined fire-glyphosate treatment in a monotypic stand of reed canarygrass. In a wet prairie in Wisconsin, researchers used fire and herbicide treatments over a 4-year period to control a dense stand of reed canarygrass (~57% cover). Experimental plots were burned in May 2001 to remove dense litter and then sprayed with glyphosate on 23 August 2001. Seedlings were allowed to establish, and a second herbicide treatment applied on 23 August 2002. Plots were burned a second time in October 2002 to remove litter. In either December 2002 or May 2003, sites were seeded with a mix of graminoids and forbs containing 33 species. Sethoxydim was applied in September 2004 and in June 2005. Plots were burned a third time in November 2004 to remove litter. Reed canarygrass average cover was initially reduced to 23.6% during the first year (summer 2003) in treated plots but by the summer of 2005 there was no significant ($P>0.05$) difference in reed canarygrass average cover between treated plots (41.6%) and control plots (57%). Although reed canarygrass remained dominant on all plots, native forb and graminoid establishment was improved on plots where sethoxydim was applied. Treated plots had an average 4.5 native species/ m^2 compared to 0.5 native species /m^2 in control plots [305].

One study in Minnesota found that reed canarygrass may be reduced when postfire herbicide treatments are timed to coincide with periods of optimal carbohydrate accumulation (see Seasonal development) to facilitate translocation of herbicide to rhizomes. To control a near monoculture of reed canarygrass, researchers combined May prescribed fire with various herbicide treatments. A native mix of graminoid and herbaceous species was seeded on the site shortly after the fire. Reed canarygrass biomass was reduced when fire was followed by either spring (mid-May) or fall (late August and late September) applications of herbicide. Reed canarygrass biomass was 75% less in the spring-herbicide treatment than in control plots and 90% less in the fall-herbicide treatment. Differences were attributed to improved translocation of the herbicide to the rhizome during periods of carbohydrate accumulation. However, reed canarygrass continued to dominate the site, preventing native species from establishing, even after 2 seasons of spring burning and fall herbicide application [1].

A study in Wisconsin found that native shrub and tree survival could be improved for planted material when fire was used following an herbicide treatment. Five treatments were evaluated to reduce reed canarygrass cover in a monotypic stand that had been planted more than 35 years before. Treatments included herbicide alone and herbicide followed by mowing, plowing, or prescribed fire. Treatments were completed in the fall and followed by a spring planting of native trees and shrubs. Survival of planted material was highest in herbicide-burned plots and herbicide-plowed plots. Herbaceous plant diversity (both native and nonnative) was also higher in plots that were burned or plowed. Additionally, planting and monitoring of woody material was easier in plots that were burned. Researchers concluded that herbicide application followed by prescribed fire may be the most effective and feasible preplanting treatment in dense stands of reed canarygrass [123].

Researchers in Tennessee, however, combined fire and herbicide in the opposite sequence and observed no improved establishment of planted material. In a monotypic stand of reed canarygrass, plots were burned in March or April and sprayed with herbicide later in April. Plots were either seeded with native herbaceous species or planted with woody or herbaceous species in May. By August, reed canarygrass cover and shoot and root biomass were similar on treated and untreated plots and remained so through the following August. In burned plots, litter biomass was 51% less in August compared to control plots and 33% less by the next August. High mortality of woody species and heavy animal browsing prevented the planted material from establishing during the first year. Researchers concluded that reed canarygrass may need to be treated for more than 2 growing seasons before planted material can establish [69].

Altered fuel characteristics: Little has been reported on reed canarygrass' fuel characteristics or its potential to alter fuel characteristics in communities it has invaded. Robertson [249] speculated that reed canarygrass may increase fuel loads where it forms dense stands or monocultures, and these conditions may result in severe fires with high rates of spread.

MANAGEMENT CONSIDERATIONS

SPECIES: Phalaris arundinacea

- FEDERAL LEGAL STATUS
- OTHER STATUS
- IMPORTANCE TO WILDLIFE AND LIVESTOCK
- OTHER USES
- IMPACTS AND CONTROL

FEDERAL LEGAL STATUS:
None

OTHER STATUS:
Information on state-level noxious weed status of plants in the United States is available at Plants Database.

IMPORTANCE TO WILDLIFE AND LIVESTOCK:
Reed canarygrass has been cultivated extensively in North America [32,215,301] for livestock and wildlife forage [215]. Reed canarygrass is generally considered good forage for livestock, particularly cattle [97,148,190,256,283]; however, its ability to survive under continuous close grazing is questionable [97,283].

As of this writing (2010), reed canarygrass' importance to wildlife has not been well documented; most available information is anecdotal. A variety of wetland and upland birds [97,151,164,191], small mammals [97,124,272], amphibians [81], fish [97], and ungulates [270] may occasionally use reed canarygrass for forage, cover, and nesting [81,97,151,191,270], but may not prefer it over native plants in many situations [70,97,181,227,270]. Reed canarygrass may threaten wetland and aquatic wildlife habitat by displacing desirable native wetland plants (see Impacts).

Palatability and/or nutritional value: Reports on reed canarygrass' palatability are variable. Agronomic researchers [190,257] claim that lack of palatability in reed canarygrass is the most frequently cited reason why it is not agronomically superior to other forage grasses. Agronomic testing in Iowa found that reed canarygrass was palatable to horses and was preferred over timothy (*Phleum pratense*) [306]. In another palatability test, reed canarygrass was preferred forage for snow geese when compared to 3 other pasture grasses and 2 legumes [81].

It has been suggested that alkaloid concentrations [84,190,257], leaf texture [97], or plant maturity [79,97,257] may influence palatability and/or nutritional value of reed canarygrass. Some strains of reed canarygrass contain high concentrations of alkaloid compounds [230], making them unpalatable and/or toxic [84,190,257]. Hansen and others [97] speculated that reed canarygrass' palatability may be reduced by the coarseness of its leaves. Reed canarygrass' palatability and nutritional quality may decline as plants mature during the growing season [79,97,152,257]. Several strains of reed canarygrass have been developed with varying degrees of palatability [257]; as these strains establish in wildlands, they may influence forage quality in wild populations.

A review by Martin and others [191] states that reed canarygrass forage value is fair for upland game birds such as ring-necked pheasants and quail in the Northeast, northern bobwhite in Texas, and some songbirds including lazuli bunting, American Pipit (Pacific coast), savannah sparrow (California), and towhee (Alberta). Although reed canarygrass is a readily available food source in Montana wetlands, it is only occasionally used by waterfowl and small mammals [97]. A variety of ungulates, particularly moose and elk, and to a lesser extent, mule deer, pronghorn [97], and white-tailed deer [97,270], use reed canarygrass as forage. Columbian white-tailed deer were observed grazing reed canarygrass, although use was relatively low on sites where it formed dense monotypes compared to other wetland plant communities [270]. Studies have documented common muskrats [272] and voles [124] foraging on reed canarygrass, but it is unclear if it is an important food source to either.

Cover and nesting value: In Montana, reed canarygrass is often used for cover by mule deer, white-tailed deer, and moose but rarely by elk. It provides fair cover for upland game birds, non-game birds, and small mammals, and good cover for waterfowl. On sites inundated long enough, stands of reed canarygrass provide cover for common muskrat [97]. Amphibians [81] and fish [97] may use reed canarygrass for breeding.

In Wisconsin, ring-necked pheasants nested on sites where reed canarygrass had been planted along with other nonnative grasses and forbs. However, on muck and peat soils, ring-necked pheasants preferred native bluejoint reedgrass over reed canarygrass when it was available [70]. Reviews from the Great Plains [269] and Montana [97] indicate that waterfowl occasionally nest in reed canarygrass. In Oregon, greater sandhill cranes occasionally used reed canarygrass for nesting but preferred spikerush [181]. Greater prairie-chickens may use reed canarygrass for roosting [275] and nesting in areas where native grasslands are scarce; however, cutting reed canarygrass for hay may decrease its nesting value if done before chicks fledge [227].

Stands of reed canarygrass may provide spawning areas and hiding cover for many species of fish [97]. One study from Quebec indicates that reed canarygrass may provide important habitat for the northern leopard frog, a species that has been commercially exploited and whose populations are in decline. In a wet meadow, northern leopard frogs preferred reed canarygrass for egg mass support (65% of egg masses) over red-osier dogwood (15%), purple loosestrife (13%), prairie cordgrass (3%), and willow (2%) [81].

OTHER USES:
Reed canarygrass has been used for erosion control [67,97,98,215], shoreline stabilization [67,94], and pollutant filtration [190]. It has been recommended for revegetation of disturbed sites such as pipeline corridors [43], firelines [21], and recently burned sites [261]. However, because reed canarygrass can dominate sites (see Habitat Types and Plant Communities) and negatively impact ecosystems, its future use in revegetation projects may be unwise. For example, when reed canarygrass was seeded with a mixture of other native species in an attempt to restore a Wisconsin prairie plant community, reed canarygrass dominated the site (>95% cover) within 6 years [128].

IMPACTS AND CONTROL:
Reed canarygrass is generally considered highly invasive within most of its North American range [37,133,148,168,197,251,303]. Several attributes may contribute to reed canarygrass' invasiveness in North America. Under cultivation, different strains of reed canarygrass vary greatly in vigor of growth, leafiness, seed retentioin, seed production, and resistance to drought [306] which may influence its invasiness. A review by Maurer and others [195] suggested that reed canarygrass is invasive because of high energy allocation to reproduction, clonal growth, long growing period, rapid growth, high productivity, and a broad tolerance to environmental variability. Under experimental conditions, reed canrygrass' rapid growth rate, tall leafy shoots, and extensive lateral spread of the canopy and rhizomes allowed it to effectively capture light and nutrients even under low nutrient and soil moisture conditions [300]. Disturbance may enhance reed canarygrass' invasiveness. In a controlled environment, reed canarygrass was more invasive where disturbance was common versus sites where little disturbance occurred [146].

Impacts: Hutchison [133] considered the nonnative type of reed canarygrass to be a "major threat" to North American wetlands, and NatureServe [224] gave reed canarygrass an impact-ranking of "high" based on its negative impacts to wetlands and riparian areas. Some of reed canarygrass' ecological impacts have been well documented, particularly in the Northwest and Great Lakes areas [15,31,35,66,145,188,234,240,248]. Reed canarygrass impacts ecosystems by reducing plant diversity [15,16,66,145,176,234], and may degrade wildlife habitat [35,110,210,248,270], interfere with wetland restoration [5,155,240,279], impede water flow [46,110], and/or influence succession.

Reed canarygrass is widely considered a threat to native wetland plant communities [5,23,58,122,144,188,195,256], and several studies document a loss of diversity in invaded communities [15,16,66,145,176,234]. In an Oregon riparian forest, increasing reed canarygrass abundance was correlated with decreasing species richness (R^2=0.2455) and understory species diversity (R^2 =0.327) in stands older than 7 years [66]. In coastal wetlands in Oregon, high reed canarygrass cover near beaver impoundments was associated with a significant (P=0.01) reduction in species richness when compared to sites with low reed canarygrass cover [234]. In Wisconsin, Kercher and others [145] noted 21% fewer species in wetland plots containing reed canarygrass compared to reference plots, and 52% fewer species on sites where natural hydrological regimes had been altered. On a river island in Wisconsin, increases in frequency of nonnative grasses, including reed canarygrass, corresponded to decreases in frequency of numerous herbaceous species common to the island. The researcher concluded that reed canarygrass had a "major impact on plant species composition and diversity on the river island" [15].

Frequency (%) of common herbaceous species on a river island in Wisconsin over a 15-year period [15]

Plant species	Native status	Growth habit	1981	1996
switchgrass (*Panicum virgatum*)	Native	perennial	54	24
Canada wildrye (*Elymus canadensis*)	Native	perennial	22	25
marshpepper knotweed (*Polygonum hydropiper*)	Nonnative	annual	14	2
prairie cordgrass	Native	perennial	12	20
prairie ironweed (*Vernonia fasciculata*)	Native	perennial	9	3
tufted lovegrass (*Eragrostis pectinacea*)	Native	annual	7	2
Kentucky bluegrass	Nonnative	perennial	7	14
reed canarygrass	Unclear	perennial	2	17

Reed canarygrass may displace rare plants like Nelson's checkerbloom (*Sidalcea nelsoniana*) in Oregon [16] and water howellia (*Howellia aquatilis*) in the inland Northwest [176].

Although there is concern for reed canarygrass' impacts to wildlife habitat (reviews by [5,110,210]), as of this writing (2010) there has been little documentation of these effects. In southwestern Minnesota and Wisconsin, Kirsh and others [151] studied riparian wet meadows dominated by reed canarygrass and their use by 4 common species of breeding birds. They determined that reed canarygrass had a negative effect on 1 species and a slight positive effect on 2 species [151]. Columbian white-tailed deer graze on reed canarygrass but prefer native wetland plant communities over monotypic stands of reed canarygrass [270]. In a survey of 12 western states, biotic integrity—based on vertebrate and macroinvertebrate occurrence— was significantly (P<0.001) lower on sites in mountainous regions where reed canarygrass occurred than where it was absent [248]. In western Washington, 158 coho salmon (an endangered species) migrating upstream during a high flood event became stranded and died in a field of reed canarygrass and pale-yellow iris (*Iris pseudacorus*) when flood waters receded quickly. Carrasco [35] speculated that dense stands of reed canarygrass and pale-yellow iris made escape from the field more difficult for the coho salmon, especially where the canal was ill-defined. The displacement of woody vegetation by reed canarygrass may reduce the number of arthropods foraging in riparian areas, which may in turn deprive juvenile salmon of an important food source (review by [210]).

Because reed canarygrass establishes in constructed or restored wetlands, it may interfere with the long-term success of wetland restoration projects [5,31,155,240,279]. On an experimental site in Minnesota, researchers evaluated the potential for native lakebank sedge (*Carex lacustris*) to establish in a former wetland dominated by reed canarygrass. After 3 years, mean biomass of sedge planted in plots with reed canarygrass was either unchanged or decreased [31]. Researchers in Minnesota speculate that reed canarygrass' large seed bank hinders wetland restoration [240].

Reed canarygrass may influence hydraulic flow of a streams [5,46,110]; however, empirical evidence is lacking. One review suggested that reed canarygrass impacts hydraulic characteristics of surface waters by clogging ditches and streams with thick thatch [5]. Comes and others [46] speculated that roots and rhizomes of reed canarygrass come in contact with water and moist soil, collecting silt and rapidly forming berms at the water's edge. Silt deposits and the emergent stems and leaves of reed canarygrass reduce the volume of water that a channel can carry and thus impede water flow [46]. An invasive plant guide from Alaska claims that reed canarygrass may slow stream flow and eliminate the scouring action needed to maintain salmon habitat [110].

Control: Reed canarygrass is difficult to control because it has vigorous, rapidly spreading rhizomes and forms a large seed bank [69,105,232,240]. Because reed canarygrass is typically found in wetlands, implementation of herbicide applications [133], mowing [263], or prescribed fire ([148], review by [8]) may be hindered or impractical on many sites. Additionally, past and present use of reed canarygrass for forage and erosion control may frustrate attempts to control it in wildlands [89].

Management strategies used for reed canarygrass control include mowing, herbicide, grazing, cultivation techniques, fire, shading, and flooding (review by [168]). Like control of most biotic invasions, control of reed canarygrass is most effective when it employs a long-term, ecosystem-wide strategy rather than a tactical approach focused on battling individual invaders [186]. Various types of publications including original research [1,18,148,161,260,305], reviews [184,251,277], and regional invasive plant management guidelines [119] generally agree that control of reed canarygrass is most effective when it includes an integrated approach implemented in a sequential and timely order. Implementing treatments based on reed canarygrass' growth characteristics and phenological stages (see Seasonal development and Seedling establishment and plant growth) may make it more vulnerable to treatment [1,251]. Regardless of which treatment options are used, the potential for post-treatment reinvasion by reed canarygrass [69,232] or other invasive species [29] should be considered. Ongoing maintenance to control sprouting and seedling establishment may be necessary to maintain long-term reed canarygrass control [1,161,305].

Prevention: It has been argued that the most cost-efficient and effective method of managing invasive species is to prevent their establishment and spread by maintaining "healthy" natural communities [186,258] (e.g., avoid road building in wildlands [280]) and by monitoring several times each year [138]. Managing to maintain the integrity of the native plant community and mitigate the factors enhancing ecosystem invasibility is likely to be more effective than managing solely to control the invader [115].

An invasive plant management guide suggested that reed canarygrass might be prevented from invading wetlands by constructing erosion screens and catch-basins around wetlands adjacent to eroding slopes [119]. Mauer and others [195] speculated that disturbance that creates canopy gaps may make a community more vulnerable to invasion by reed canarygrass and recommended maintaining a dense canopy to discourage reed canarygrass invasion. They also recommended the quick removal of new populations of reed canarygrass to prevent its spread [195].

Cultural control: Shading has been suggested as a control for reed canarygrass [5,119,149,236]; however, reed canarygrass' response to shade is not well understood [236]. Results from field and laboratory studies indicate that shade may reduce reed canarygrass' aboveground biomass but not its tiller production (see Shade tolerance).

Seeding and planting of native species have been used in conjunction with other treatments to control reed canarygrass (see Integrated Management and Use of prescribed fire), although reed canarygrass may quickly displace planted or seeded species if its rhizomes are not removed [69]. In reed canarygrass infestations, planted woody species may survive better than seeded species [69]. In Washington, within 2 years after planting willows in a monotypic stand of reed canarygrass, its biomass was reduced by 56.1% (where plantings were 0.91 m apart) and 68.0% (where plantings were 0.60 m apart) relative to controls. The decrease in reed canarygrass was attributed to increased shade from willows [149]. To control reed canarygrass, Iannone and others [134,135] encourage the use of long-lived native perennial species rather than native annuals or short lived-perennials [134,236], because the latter may prevent desired native species from establishing and result in a reed canarygrass-dominated community [135].

Hydrological manipulation: Reed canarygrass may establish by seed and/or rhizomes following drawdown, even on sites treated with herbicide [232]. Some have speculated that the draining of wetlands for agriculture may help to spread reed canarygrass [148] and that restoring water levels may help control reed canarygrass [133].

Flooding has been suggested as a control for reed canarygrass [133,137,153,167,251], and several studies have evaluated its potential. In Oregon, within 1 year of restoring historical flooding regimes to a slough, reed canarygrass cover was reduced by as much as 10.7% [137]. A Wisconsin marsh had been dominated by reed canarygrass, but it was nearly eliminated following 3 years of flooding and a subsequent drawdown [19]. In the greenhouse flooding to a depth of 2.6 inches (6.5 cm) above the soil surface for 1 month decreased rhizome survival and aboveground biomass by as much as 20% compared to plants grown in saturated or moist soils [196]. A study from the Czech Republic indicated that reed canarygrass' rhizome growth and tillering may be reduced by flooding, particularly flooding in the summer [153].

Occasionally reed canarygrass responds favorably to flooding. Reed canarygrass established in wetlands that were reflooded following a 5-year-drawdown [101]. In a controlled environment, reed canarygrass biomass was greater for plants exposed to prolonged flooding compared to nonflooded plants [146].

Flooding may be most effective at controlling reed canarygrass when timed to coincide with maximum rhizome growth and tillering [137,153] (see Seasonal Development). Lavergne and Molofsky [167] concluded that more empirical data are needed to assess whether hydrological manipulation, especially water levels and inundation periods, could limit reed canarygrass' vegetative spread. Gillespie [82] cautioned that using flooding for reed canarygrass control may be costly and water levels difficult to manipulate.

Physical or mechanical control: Hand-pulling reed canarygrass is too labor intensive and time-consuming for large stands (review by [133]), although it may be effective for controlling small stands (reviews by [8,119,133]). In an oak savanna in Wisconsin, hand-pulling controlled reed canarygrass when treatments were carried out 2 to 3 times a year over a 5-year period [105]. Covering reed canarygrass with black plastic or fabric may kill small stands of reed canarygrass [5,105,119,177,279], but rhizomes may survive (review by [119]). Covering may be more effective at controlling reed canarygrass if done in conjunction with other treatments such as mowing and native plant seeding [105,177].

Mowing, plowing, cutting, raking, and disking have all been evaluated for reed canarygrass control. If used independently, mechanical control typically produces short-term reed canarygrass control at best ([95,148,240,301], review by [133]). Often there is no long-term effect ([95,148], review by [133]), because reed canarygrass grows back from the seed bank [148,240] or may sprout from rhizomes or produce tillers from the root crown (see Vegetative regeneration). In some instances, cutting may increase reed canarygrass growth (review by [190]) and mowing may increase tiller production [279]. Mechanical treatments may be more effective at controlling reed canarygrass when included as part of a well coordinated integrated management plan.

Biological control: As of this writing (2010), no biological control agents have been developed for reed canarygrass. Reed canarygrass may not survive sustained grazing [97,283], but grazing may be impractical for reed canarygrass control in wetlands (review by [133]).

Chemical control: Some herbicides control reed canarygrass (review by [251]), especially when used in conjunction with other treatments such as fire, mechanical control, and/or native seed dispersal (see Integrated management). Studies documenting the long-term effects of herbicide treatments have found that when used independently, herbicides may provide short-term reed canarygrass control at best [1,69,105,177]. Even when used in conjunction with other treatments, several herbicide applications may be necessary to prevent its reestablishment from the seed bank or rhizomes [1,69,105,119,240,279,305]. In Tennessee, 1 application of herbicide failed to prevent reed canarygrass seedlings from establishing in a monotypic stand and may have facilitated germination by creating canopy gaps [69]. In Minnesota, 2 herbicide treatments (1 in late August and 1 in late September) did not reduce reed canarygrass seed bank densities compared to control plots (280 seeds/m²), but 2 years of herbicide treatments did (60-

120 seeds/m²). Repeated late-season herbicide treatments, however, did not prevent remaining seed from germinating [1,305].

Herbicide treatments, whether used independently or in conjunction with other controls, may be more effective when timed to take advantage of reed canarygrass' vulnerable phenological stages ([1], review by [251]). Rosburg [251] suggested that early spring or late fall herbicide applications, coinciding with reed canarygrass' photosynthetically active periods, may improve herbicide selectivity and avoid stressing native species. In Minnesota, 2 years of fall herbicide applications, timed to coincide with optimal carbohydrate accumulation in reed canarygrass rhizomes, were twice as effective at controlling reed canarygrass as 2 years of spring applications [1]. In the eastern Great Plains area, reed canarygrass rhizomes survived spring herbicide applications; however, late October and early November application killed reed canarygrass rhizomes completely [161].

Glyphosate products, approved for use in aquatic environments, have been used to kill reed canarygrass [1,69,148,161,177,240,260,305] and are commonly recommended ([46,105,263], reviews by [5,133]) for its control. One study from Illinois [260] and another from Wisconsin [305] evaluated using sethoxydim to control reed canarygrass. Both studies indicate that, when used in conjunction with fire and glyphosate, sethoxydim may improve opportunities for native plants to establish [260,305] (see Use of prescribed fire); however, its use is limited to sites without standing water [260]. Occasionally, amitrol and dalapon have been recommended for reed canarygrass control, but they may not be appropriate for use in wildlands and aquatic environments ([46,116,263], review by [119]).

Herbicides are effective in gaining initial control of a new invasion or a severe infestation, but they are rarely a complete or long-term solution to weed management [33]. Additionally, most herbicides are not selective enough to treat reed canarygrass on wildlands ([177,263], review by [133]). See the Weed control methods handbook [278] for considerations on the use of herbicides in natural areas, particularly wetlands and riparian areas, and detailed information on specific chemicals.

Integrated management: Numerous studies [1,69,148,149,161,177,260,305] have evaluated various integrated management approaches to control reed canarygrass, and several offer potential control treatments [1,148,149,161,260,305]. Researchers have used combinations of mowing, herbicide, and fire to control reed canarygrass, and to a lesser extent disking, shading, black plastic, and flooding [1,5,69,148,149,161,177,200,260,305]. Treatments often include or are followed-up with a seeding or planting of native species [69,105,149,161,260,305]. Successful strategies require a multiple-year commitment including long-term maintenance. To obtain optimal results, treatments are typically carried out in a particular order and timing sequence. Several studies describe these sequences in detail [1,148,149,161,260,305].

Several studies report the effects of using fire in combination with other treatments to reduce reed canarygarss and are discussed in the Use of prescribed fire section.

APPENDIX: FIRE REGIME TABLE

SPECIES: Phalaris arundinacea

The following table provides fire regime information that may be relevant to reed canarygrass habitats. Follow the links in the table to documents that provide more detailed information on these fire regimes.

Fire regime information on vegetation communities in which reed canarygrass may occur. This information is taken from the LANDFIRE Rapid Assessment Vegetation Models [163], which were developed by local experts using available literature, local data, and/or expert opinion. This table summarizes fire regime characteristics for each plant community listed. The PDF file linked from each plant community name describes the model and synthesizes the knowledge available on vegetation composition, structure, and dynamics in that community. Cells are blank where information is not available in the Rapid Assessment Vegetation Model.

Pacific Northwest	California	Southwest	Great Basin
Northern and Central Rockies	Northern Great Plains	Great Lakes	Northeast

Pacific Northwest

- Northwest Grassland
- Northwest Woodland

Vegetation Community (Potential Natural Vegetation Group)	Fire severity*	Fire regime characteristics			
		Percent of fires	Mean interval (years)	Minimum interval (years)	Maximum interval (years)
Northwest Grassland					
Marsh	Replacement	74%	7		
	Mixed	26%	20		
Northwest Woodland					
Oregon white oak	Replacement	3%	275		
	Mixed	19%	50		
	Surface or low	78%	12.5		

California

- California Woodland

Vegetation Community (Potential Natural Vegetation Group)	Fire severity*	Fire regime characteristics			
		Percent of fires	Mean interval (years)	Minimum interval (years)	Maximum interval (years)
California Woodland					
California oak woodlands	Replacement	8%	120		
	Mixed	2%	500		
	Surface or low	91%	10		

Southwest

- Southwest Forested

Vegetation Community (Potential Natural Vegetation Group)	Fire severity*	Fire regime characteristics			
		Percent of fires	Mean interval (years)	Minimum interval (years)	Maximum interval (years)

Southwest Forested					
Riparian forest with conifers	Replacement	100%	435	300	550
Riparian deciduous woodland	Replacement	50%	110	15	200
	Mixed	20%	275	25	
	Surface or low	30%	180	10	

Great Basin

- Great Basin Grassland

Vegetation Community (Potential Natural Vegetation Group)	Fire severity*	Fire regime characteristics			
		Percent of fires	Mean interval (years)	Minimum interval (years)	Maximum interval (years)
Great Basin Grassland					
Great Basin grassland	Replacement	33%	75	40	110
	Mixed	67%	37	20	54

Northern and Central Rockies

- Northern and Central Rockies Shrubland

Vegetation Community (Potential Natural Vegetation Group)	Fire severity*	Fire regime characteristics			
		Percent of fires	Mean interval (years)	Minimum interval (years)	Maximum interval (years)
Northern and Central Rockies Shrubland					
Riparian (Wyoming)	Mixed	100%	100	25	500

Northern Great Plains

- **Northern Plains Grassland**
- **Northern Plains Woodland**

Vegetation Community (Potential Natural Vegetation Group)	Fire severity*	Fire regime characteristics			
		Percent of fires	Mean interval (years)	Minimum interval (years)	Maximum interval (years)
Northern Plains Grassland					
Nebraska Sandhills prairie	Replacement	58%	11	2	20
	Mixed	32%	20		
	Surface or low	10%	67		

Northern mixed-grass prairie	Replacement	67%	15	8	25
	Mixed	33%	30	15	35
Southern mixed-grass prairie	Replacement	100%	9	1	10
Central tallgrass prairie	Replacement	75%	5	3	5
	Mixed	11%	34	1	100
	Surface or low	13%	28	1	50
Northern tallgrass prairie	Replacement	90%	6.5	1	25
	Mixed	9%	63		
	Surface or low	2%	303		
Southern tallgrass prairie (East)	Replacement	96%	4	1	10
	Mixed	1%	277		
	Surface or low	3%	135		
Oak savanna	Replacement	7%	44		
	Mixed	17%	18		
	Surface or low	76%	4		
Northern Plains Woodland					
Oak woodland	Replacement	2%	450		
	Surface or low	98%	7.5		
Northern Great Plains wooded draws and ravines	Replacement	38%	45	30	100
	Mixed	18%	94		
	Surface or low	43%	40	10	
Great Plains floodplain	Replacement	100%	500		

Great Lakes

- Great Lakes Grassland
- Great Lakes Woodland
- Great Lakes Forested

Vegetation Community (Potential Natural Vegetation Group)	Fire severity*	Fire regime characteristics			
		Percent of fires	Mean interval (years)	Minimum interval (years)	Maximum interval (years)
Great Lakes Grassland					
Mosaic of bluestem prairie and oak-hickory	Replacement	79%	5	1	8
	Mixed	2%	260		
	Surface or low	20%	2		33

Great Lakes Woodland					
Northern oak savanna	Replacement	4%	110	50	500
	Mixed	9%	50	15	150
	Surface or low	87%	5	1	20
Great Lakes Forested					
Great Lakes floodplain forest	Mixed	7%	833		
	Surface or low	93%	61		

Northeast

- Northeast Grassland

Vegetation Community (Potential Natural Vegetation Group)	Fire severity*	Fire regime characteristics			
		Percent of fires	Mean interval (years)	Minimum interval (years)	Maximum interval (years)
Northeast Grassland					
Northern coastal marsh	Replacement	97%	7	2	50
	Mixed	3%	265	20	

*Fire Severities—
Replacement: Any fire that causes greater than 75% top removal of a vegetation-fuel type, resulting in general replacement of existing vegetation; may or may not cause a lethal effect on the plants.
Mixed: Any fire burning more than 5% of an area that does not qualify as a replacement, surface, or low-severity fire; includes mosaic and other fires that are intermediate in effects.
Surface or low: Any fire that causes less than 25% upper layer replacement and/or removal in a vegetation-fuel class but burns 5% or more of the area [96,162].

Phalaris arundinacea: REFERENCES

1. Adams, Carrie Reinhardt; Galatowitsch, Susan M. 2006. Increasing the effectiveness of reed canary grass (Phalaris arundinacea L.) control in wet meadow restorations. Restoration Ecology. 14(3): 441-451. [64258]

2. Ali, S. I.; Qaiser, M.; [and others]. 2010. Flora of Pakistan, [Online]. Islamabad: Pakistan Agricultural Research Council; Karachi, Pakistan: University of Karachi; St. Louis, MO: Missouri Botanical Garden. In: eFloras. St. Louis, MO: Missouri Botanical Garden; Cambridge, MA: Harvard University Herbaria (Producers). Available: http://www.efloras.org/flora_page.aspx?flora_id=5; http://www.mobot.org/MOBOT/research/pakistan/welcome.shtml [73152]

3. Allard, H. A.; Evans, Morgan W. 1941. Growth and flowering of some tame and wild grasses in response to different photoperiods. Journal of Agricultural Research. 62(4): 193-228. [77617]

4. Alway, Frederick J. 1931. Early trials and use of reed canary grass as a forage plant. Journal of the

American Society of Agronomy. 23(1): 64-66. [78272]

5. Antieau, Clayton J. 2000. Emerging themes in reed canarygrass management. In: Riparian ecology and management in multi-land use watersheds: Proceedings, AWRA's 2000 summer specialty conference; 2000 August 28-31; Portland, OR. Technical Publication Series No. TPS 00-2. Middleburg, VA: American Water Resources Association: 545-550. [37583]

6. Anzinger, Dawn; Radosevich, Steven R. 2008. Fire and nonnative invasive plants in the Northwest Coastal bioregion. In: Zouhar, Kristin; Smith, Jane Kapler; Sutherland, Steve; Brooks, Matthew L., eds. Wildland fire in ecosystems: fire and nonnative invasive plants. Gen. Tech. Rep. RMRS-GTR-42-vol. 6. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 197-224. [70906]

7. Apfelbaum, Stephen I.; Sams, Charles E. 1987. Ecology and control of reed canary grass (Phalaris arundinacea L.). Natural Areas Journal. 7(2): 69-74. [5725]

8. Apfelbaum, Steven L. 1996. Phalaris arundinacea--reed canary grass. In: Randall, John M.; Marinelli, Janet, eds. Invasive plants: Weeds of the global garden. Handbook #149. Brooklyn, NY: Brooklyn Botanic Garden: 90. [73460]

9. Apfelbaum, Steven L.; Rouffa, Albert S. 1983. James Woodworth Praire Preserve: a case history of the ecological monitoring programs. In: Brewer, Richard, ed. Proceedings of the 8th North American praire conference; 1982 August 1-4; Kalamazoo, MI. Kalamazoo, MI: Western Michigan University, Department of Biology: 27-30. [77957]

10. Asher, Jerry; Dewey, Steven; Olivarez, Jim; Johnson, Curt. 1998. Minimizing weed spread following wildland fires. Proceedings, Western Society of Weed Science. 51: 49. Abstract. [40409]

11. Ashworth, Sharon M. 1997. Comparison between restored and reference sedge meadow wetlands in south-central Wisconsin. Wetlands. 17(4): 518-527. [54315]

12. Baltensperger, A. A.; Kalton, R. R. 1958. Variability in reed canarygrass, Phalaris arundinacea L. II. Seed shattering. Agronomy Journal. 51: 37-38. [77618]

13. Barclay, A. M.; Crawford, R. M. M. 1982. Plant growth and survival under strict anaerobiosis. Journal of Experimental Botany. 33(134): 541-549. [77956]

14. Barkworth, Mary E.; Capels, Kathleen M.; Long, Sandy; Anderton, Laurel K.; Piep, Michael B., eds. 2007. Flora of North America north of Mexico. Volume 24: Magnoliophyta: Commelinidae (in part): Poaceae, part 1. New York: Oxford University Press. 911 p. [68092]

15. Barnes, William J. 1999. The rapid growth of a population of reed canarygrass (Phalaris arundinacea L.) and its impact on some riverbottom herbs. Journal of the Torrey Botanical Society. 126(2): 133-138. [55972]

16. Bartels, Marilynn R.; Wilson, Mark V. 2001. Fire and mowing as management tools for conserving a threatened perennial and its habitat in the Willamette Valley, Oregon. In: Bernstein, Neil P.; Ostrander, Laura J., eds. Seeds for the future; roots of the past: Proceedings of the 17th North American prairie conference; 2000 July 16-20; Mason City, IA. Mason City, IA: North Iowa Community College: 59-65. [46494]

17. Bendell, J. F. 1974. Effects of fire on birds and mammals. In: Kozlowski, T. T.; Ahlgren, C. E., eds. Fire and ecosystems. New York: Academic Press: 73-138. [16447]

18. Betz, Robert F. 1986. One decade of research in prairie restoration at the Fermi National Accelerator

Laboratory (FERMILAB) Batavia, Illinois. In: Clambey, Gary K.; Pemble, Richard H., eds. The prairie: past, present and future: Proceedings of the 9th North American prairie conference; 1984 July 29 - August 1; Moorhead, MN. Fargo, ND: Tri-College University Center for Environmental Studies: 179-185. [3565]

19. Beule, John D. 1979. Control and management of cattails in southeastern Wisconsin wetlands. Tech. Bull No. 112. Madison, WI: Department of Natural Resources. 40 p. [14574]

20. Bliss, L. C.; Wein, R. W. 1972. Plant community responses to disturbances in the western Canadian Arctic. Canadian Journal of Botany. 50: 1097-1109. [14877]

21. Bolstad, Roger. 1971. Catline rehabilitation and restoration. In: Slaughter, C. W.; Barney, Richard J.; Hansen, G. M., eds. Fire in the northern environment--a symposium: Proceedings; 1971 April 13-14; Fairbanks, AK. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Range and Experiment Station: 107-116. [15723]

22. Bonilla-Warford, Cristina M.; Zedler, Joy B. 2002. Potential for using native plant species in stormwater wetlands. Environmental Management. 29(3): 385-394. [78422]

23. Borgmann, Marian; Jonas, Jayne. 2003. The vascular plant community composition of three fens in the sandhills of Nebraska. In: Fore, Stephanie, ed. Promoting prairie: Proceedings of the 18th North American prairie conference; 2002 June 23-27; Kirksville, MO. Kirksville, MO: Truman State University Press: 164-173. [67090]

24. Bowles, Marlin; Jones, Michael. 2006. Testing the efficacy of species richness and floristic quality assessment of quality, temporal change, and fire effects in tallgrass prairie natural areas. Natural Areas Journal. 26(1): 17-30. [61526]

25. Brenchley, Winifred E.; Adam, Helen. 1915. Recolonisation of cultivated land allowed to revert to natural conditions. Journal of Ecology. 3(4): 193-210. [73921]

26. Brix, H.; Sorrell, B. K. 1996. Oxygen stress in wetland plants: comparison of de-oxygenated and reducing root environments. Functional Ecology. 10(4): 521-526. [77369]

27. Brodersen, Craig; Lavergne, Sebastien; Molofsky, Jane. 2008. Genetic variation in photosynthetic characteristics among invasive and native populations of reed canarygrass (Phalaris arundinacea). Biological Invasions. 10: 1317-1325. [73495]

28. Brooks, Matthew L. 2008. Effects of fire suppression and postfire management activities on plant invasions. In: Zouhar, Kristin; Smith, Jane Kapler; Sutherland, Steve; Brooks, Matthew L., eds. Wildland fire in ecosystems: Fire and nonnative invasive plants. Gen. Tech. Rep. RMRS-GTR-42-vol. 6. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 269-280. [70909]

29. Brooks, Matthew L.; Pyke, David A. 2001. Invasive plants and fire in the deserts of North America. In: Galley, Krista E. M.; Wilson, Tyrone P., eds. Proceedings of the invasive species workshop: The role of fire in the control and spread of invasive species; Fire conference 2000: 1st national congress on fire ecology, prevention, and management; 2000 November 27 - December 1; San Diego, CA. Misc. Publ. No. 11. Tallahassee, FL: Tall Timbers Research Station: 1-14. [40491]

30. Brown, Cathy Roberta. 1990. Avian use of native and exotic riparian habitats on the Snake River, Idaho. Fort Collins, CO: Colorado State University. 60 p. Thesis. [53195]

31. Budelsky, Rachel A.; Galtowitsch, Susan M. 2000. Effects of water regime and competition on the establishment of a native sedge in restored wetlands. Journal of Applied Ecology. 37(6): 971-985. [77423]

32. Bultsma, Paul M.; Haas, Russell J. 1989. Grass varieties for North Dakota. R-794 [Revised]. Fargo,

ND: North Dakota State University, Extension Service. 7 p. [19474]

33. Bussan, Alvin J.; Dyer, William E. 1999. Herbicides and rangeland. In: Sheley, Roger L.; Petroff, Janet K., eds. Biology and management of noxious rangeland weeds. Corvallis, OR: Oregon State University Press: 116-132. [35716]

34. Caldwell, Fredricka Ann; Crow, Garrett E. 1992. A floristic and vegetation analysis of a freshwater tidal marsh on the Merrimack River, West Newbury, Massachusetts. Rhodora. 94(877): 63-97. [18126]

35. Carrasco, Ken. 2000. Coho pre-spawn mortalities in a flooded reed canarygrass habitat, [Online]. In: Reed Canarygrass Working Group conference; 2000 March 15; Olympia, WA. In: Resource library: Reed canary grass information--Reed Canarygrass Working Group documents. Tucson, AZ: Society for Ecological Restoration International, Northwest Chapter (Producer). Available: http://www.ser.org/sernw/pdf/RCG2000_1.pdf [2010, February 16]. [78998]

36. Casler, M. D.; Hovin, A. W. 1980. Genetics of vegetation stand establishment characters in reed canarygrass clones. Crop Science. 20(4): 511-515. [77610]

37. Catling, Paul; Mitrow, Gisele. 2005. A prioritized list of the invasive alien plants of natural habitats in Canada. Canadian Botanical Association Bulletin. 38(4): 55-57. [71460]

38. Chapin, David M.; Beschta, Robert L.; Shen, Hsieh Wen. 2002. Relationships between flood frequencies and riparian plant communities in the upper Klamath Basin, Oregon. Journal of the American Water Resources Association. 38(3): 603-617. [43834]

39. Chapman, Rachel Ross; Crow, Garrett E. 1981. Raunkiaer's life form classification in relation to fire. Bartonia. Philadelphia, PA: Philadelphia Botanical Club. 48: 19-33. [53612]

40. Choi, Young D.; Bury, Carolyn. 2003. Process of floristic degradation in urban and suburban wetlands in northwestern Indiana, USA. Natural Areas Journal. 23(4): 320-331. [47015]

41. Clambey, Gary K.; Landers, Roger Q. 1978. A survey of wetland vegetation in north-central Iowa. In: Glenn-Lewin, David C.; Landers, Roger Q., Jr., eds. Proceedings, 5th Midwest prairie conference; 1976 August 22-24; Ames, IA. Ames, IA: Iowa State University: 32-35. [3304]

42. Clotfelter, Ethan D.; Yasukawa, Ken; Newsome, Richard D. 1999. The effects of prescribed burning and habitat edges on brown-headed cowbird parasitism of red-winged blackbirds. Studies in Avian Biology. 18: 275-281. [40136]

43. Cody, William J.; MacInnes, Kaye L.; Cayoutte, Jacques; Darbyshire, Stephen. 2000. Alien and invasive native vascular plants along the Norman Wells Pipeline Project, District of Mackenzie, Northwest Territories. The Canadian Field Naturalist. 114(1): 126-137. [43573]

44. Colbry, Vera L. 1953. Factors affecting the germination of reed canary grass. In: Clark, B. E., ed. Proceedings of the Association of Official Seed Analysts: 43rd annual meeting; 1953 July 13-17; Lincoln, NE. [Washington, DC]: Association of Official Seed Analysts: 50-56. [78301]

45. Comes, R. D.; Bruns, V. F.; Kelley, A. D. 1978. Longevity of certain weed and crop seeds in fresh water. Weed Science. 26(4): 336-344. [50697]

46. Comes, Richard D.; Marquis, Louis Y.; Kelley, Allen D. 1981. Response of seedlings of three perennial grasses to dalapon, amitorle, and glyphosate. Weed Science. 29(5): 619-621. [77896]

47. Coops, Hugo; Van der Velde, Gerard. 1995. Seed dispersal, germination and seedling growth of six helophyte species in relation to water-level zonation. Freshwater Biology. 34(1): 13-20. [73522]

48. Cowell, C. Mark; Dyer, James M. 2002. Vegetation development in a modified riparian environment: human imprints on an Allegheny River wilderness. Annals of the Association of American Geographers. 92(2): 189-202. [77846]

49. Crawford, Rex C.; Kagan, Jimmy. 2001. 25. Eastside riparian-wetlands. In: Chappell, Christopher B.; Crawford, Rex C.; Barrett, Charley; Kagan, Jimmy; Johnson, David H.; O'Mealy, Mikell; Green, Greg A.; Ferguson, Howard L.; Edge, W. Daniel; Greda, Eva L.; O'Neil, Thomas A. Wildlife habitats: descriptions, status, trends, and system dynamics. In: Johnson, David H.; O'Neil, Thomas A., eds. Wildlife-habitat relationships in Oregon and Washington. Corvallis, OR: Oregon State University Press: 98-100. [67918]

50. Cronquist, Arthur; Holmgren, Arthur H.; Holmgren, Noel H.; Reveal, James L.; Holmgren, Patricia K. 1977. Intermountain flora: Vascular plants of the Intermountain West, U.S.A. Vol. 6: The Monocotyledons. New York: Columbia University Press. 584 p. [719]

51. Curtis, John T. 1959. Fen, meadow, and bog. In: The vegetation of Wisconsin. Madison, WI: The University of Wisconsin Press: 361-381. [60530]

52. Curtis, John T. 1959. Weed communities. In: The vegetation of Wisconsin. Madison, WI: The University of Wisconsin Press: 412-434. [60533]

53. Czarapata, Elizabeth J. 2005. Invasive plants of the Upper Midwest: An illustrated guide to their identification and control. Madison, WI: The University of Wisconsin Press. 215 p. [71442]

54. DeFerrari, Collette M.; Naiman, Robert J. 1994. A multi-scale assessment of the occurrence of exotic plants on the Olympic Peninsula, Washington. Journal of Vegetation Science. 5: 247-258. [23698]

55. Dibble, Alison C.; Zouhar, Kristin; Smith, Jane Kapler. 2008. Fire and nonnative invasive plants in the Northeast bioregion. In: Zouhar, Kristin; Smith, Jane Kapler; Sutherland, Steve; Brooks, Matthew L., eds. Wildland fire in ecosystems: fire and nonnative invasive plants. Gen. Tech. Rep. RMRS-GTR-42-vol. 6. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 61-90. [70902]

56. Dix, R. L.; Smeins, F. E. 1967. The prairie, meadow, and marsh vegetation of Nelson County, North Dakota. Canadian Journal of Botany. 45: 21-58. [5528]

57. Dixon, Mark D.; Johnson, W. Carter. 1999. Riparian vegetation along the middle Snake River, Idaho: zonation, geographical trends, and historical changes. Great Basin Naturalist. 59(1): 18-34. [37548]

58. Dore, William G.; McNeill, J. 1980. Grasses of Ontario. Monograph No. 26. Ottawa, ON: Agriculture Canada, Research Branch. 566 p. [78617]

59. Duebbert, Harold F.; Jacobson, Erling T.; Higgins, Kenneth F.; Podoll, Erling B. 1981. Establishment of seeded grasslands for wildlife habitat in the prairie pothole region. Special Scientific Report: Wildlife No. 234. Washington, DC: U.S. Department of the Interior, Fish and Wildlife Service. 21 p. [5740]

60. Durbian, Francis E. 2006. Effects of mowing and summer burning on the massasauga (Sistrurus catenatus). The American Midland Naturalist. 155(2): 329-334. [62645]

61. Dwire, Kathleen A.; Kauffman, J. Boone. 2003. Fire and riparian ecosystems in landscapes of the western USA. In: Young, Michael K.; Gresswell, Robert E.; Luce, Charles H., eds. Selected papers from an international symposium on effects of wildland fire on aquatic ecosystems in the western USA; 2002 April 22-24; Boise, ID. In: Forest Ecology and Management. Special Issue: The effects of wildland fire on aquatic ecosystems in the western USA. New York: Elsevier Science B. V.; 178(1-2): 61-74. [44923]

62. Evans, Morgan W.; Ely, J. E. 1935. The rhizomes of certain species of grasses. Journal of the

American Society of Agronomy. 27(10): 791-797. [25522]

63. Evans, Morgan W.; Ely, J. Elbert. 1941. Growth habits of reed canarygrass. Journal of the American Society of Agronomy. 33: 1017-1027. [78148]

64. Fernald, Merritt Lyndon. 1950. Gray's manual of botany. [Corrections supplied by R. C. Rollins]. Portland, OR: Dioscorides Press. 1632 p. (Dudley, Theodore R., gen. ed.; Biosystematics, Floristic & Phylogeny Series; vol. 2). [14935]

65. Fierke, Melissa K.; Kauffman, J. Boone. 2005. Structural dynamics of riparian forests along a black cottonwood successional gradient. Forest Ecology and Management. 215(1-3): 149-162. [55572]

66. Fierke, Melissa K.; Kauffman, J. Boone. 2006. Invasive species influence riparian plant diversity along a successional gradient, Willamette River, Oregon. Natural Areas Journal. 26(4): 376-382. [65074]

67. Figiel, Chester R., Jr.; Collins, Beverly; Wein, Gary. 1995. Variation in survival and biomass of two wetland grasses at different nutrient and water levels over a six week period. Bulletin of the Torrey Botanical Club. 122(1): 24-29. [77354]

68. Fortney, Ronald H. 2000. Plant communities of West Virginia wetlands. West Virginia Academy of Science. 72(3): 41-54. [68447]

69. Foster, Richard D.; Wetzel, Paul R. 2005. Invading monotypic stands of Phalaris arundinacea: a test of fire, herbicide, and woody and herbaceous native plant groups. Restoration Ecology. 13(2): 318-324. [77436]

70. Frank, Edward J.; Woehler, Eugene E. 1969. Production of nesting and winter cover for pheasants in Wisconsin. The Journal of Wildlife Management. 33(4): 802-810. [77399]

71. Friedman, Jonathan M.; Osterkamp, W. R.; Lewis, William M., Jr. 1996. Channel narrowing and vegetation development following a Great Plains flood. Ecology. 77(7): 2167-2181. [55984]

72. Frieswyk, Christin B.; Zedler, Joy B. 2006. Do seed banks confer resilience to coastal wetlands invaded by Typha xglauca? Canadian Journal of Botany. 84(12): 1882-1893. [68093]

73. Frolik, A. L. 1941. Vegetation on the peat lands of Dane County, Wisconsin. Ecological Monographs. 11(1): 117-140. [16805]

74. Frost, Cecil C. 1995. Presettlement fire regimes in southeastern marshes, peatlands, and swamps. In: Cerulean, Susan I.; Engstrom, R. Todd, eds. Fire in wetlands: a management perspective: Proceedings, 19th Tall Timbers fire ecology conference; 1993 November 3-6; Tallahassee, FL. No. 19. Tallahassee, FL: Tall Timbers Research Station: 39-60. [26949]

75. Fryxell, Paul A. 1957. Mode of reproduction of higher plants. Botanical Review. 23: 135-233. [67749]

76. Galatowitsch, Susan M.; Anderson, Neil O.; Ascher, Peter D. 1999. Invasiveness in wetland plants in temperate North America. Wetlands. 19(4): 733-755. [37543]

77. Garren, Kenneth H. 1943. Effects of fire on vegetation of the southeastern United States. Botanical Review. 9: 617-654. [9517]

78. Gates, Frank C. 1942. The bogs of northern Lower Michigan. Ecological Monographs. 12(3): 213-254. [10728]

79. Gibson, David J.; Middleton, Beth A.; Foster, Kari; Honu, Yohanes A. K.; Hoyer, Erik W.; Mathis, Marilyn. 2005. Species frequency dynamics in an old-field succession: effects of disturbance, fertilization

and scale. Journal of Vegetation Science. 16(4): 415-422. [61203]

80. Gifford, Amy L. S.; Ferdy, Jean-Baptiste; Molofsky, Jane. 2002. Genetic composition and morphological variation among populations of the invasive grass, Phalaris arundinacea. Canadian Journal of Botany. 80: 779-785. [42267]

81. Gilbert, Mireille; Leclair, Raymond, Jr.; Fortin, Rejean. 1994. Reproduction of the northern leopard frog (Rana pipiens) in floodplain habitat in the Richelieu River, P. Quebec, Canada. Journal of Herpetology. 28(4): 465-470. [77388]

82. Gillespie, JoAnn; Murn, Thomas. 1992. Mowing controls reed canary grass, releases native wetland plants. Restoration & Management Notes. 10(1): 93-94. [19413]

83. Gleason, H. A.; Cronquist, A. 1963. Manual of vascular plants of northeastern United States and adjacent Canada. Princeton, NJ: D. Van Nostrand Company, Inc. 810 p. [7065]

84. Gomm, F. B. 1979. Herbage yield and nitrate concentration in meadow plants as affected by environmental variables. Journal of Range Management. 32(5): 359-364. [77398]

85. Goodwin, Kim; Sheley, Roger; Clark, Janet. 2002. Integrated noxious weed management after wildfires. EB-160. Bozeman, MT: Montana State University, Extension Service. 46 p. Available online: http://www.montana.edu/wwwpb/pubs/eb160.html [2003, October 1]. [45303]

86. Goss, W. L. 1924. The vitality of buried seeds. Journal of Agricultural Research. 29(7): 349-362. [35541]

87. Great Plains Flora Association. 1986. Flora of the Great Plains. Lawrence, KS: University Press of Kansas. 1392 p. [1603]

88. Green, Emily K.; Galatowitsch, Susan M. 2001. Differences in wetland plant community establishment with additions of nitrate-N and invasive species (Phalaris arundinacea and Typha xglauca). Canadian Journal of Botany. 79(2): 170-178. [77612]

89. Green, Emily K.; Galatowitsch, Susan M. 2002. Effects of Phalaris arundinacea and nitrate-N addition on the establishment of wetland plant communities. Journal of Applied Ecology. 39(1): 134-144. [77334]

90. Griffith, W. L.; Harrison, C. M. 1954. Maturity and curing temperature and their influence on the germination of reed canarygrass. Agronomy Journal. 46: 163-168. [77619]

91. Grime, J. P.; Hunt, Roderick. 1975. Relative growth-rate: its range and adaptive significance in a local flora. Journal of Ecology. 63(2): 393-422. [72183]

92. Grime, J. P.; Mason, G.; Curtis, A. V.; Rodman, J.; Band, S. R.; Mowforth, M. A. G.; Neal, A. M.; Shaw, S. 1981. A comparative study of germination characteristics in a local flora. The Journal of Ecology. 69(3): 1017-1059. [70060]

93. Hale, Brack W.; Alsum, Esther M.; Adams, Michael S. 2008. Changes in the floodplain forest vegetation of the Lower Wisconsin River over the last fifty years. The American Midland Naturalist. 160(2): 454-476. [73022]

94. Hall, James B.; Hansen, Paul L. 1997. A preliminary riparian habitat type classification system for the Bureau of Land Management districts in southern and eastern Idaho. Tech. Bull. No. 97-11. Boise, ID: U.S. Department of the Interior, Bureau of Land Management; Missoula, MT: University of Montana, School of Forestry, Riparian and Wetland Research Program. 381 p. [28173]

95. Halvorsen, Harvey H.; Anderson, Raymond K. 1983. Evaluation of grassland management for wildlife in central Wisconsin. In: Kucera, Clair L., ed. Proceedings, 7th North American prairie conference; 1980 August 4-6; Springfield, MO. Columbia, MO: University of Missouri: 267-279. [3228]

96. Hann, Wendel; Havlina, Doug; Shlisky, Ayn; [and others]. 2008. Interagency fire regime condition class guidebook. Version 1.3, [Online]. In: Interagency fire regime condition class website. U.S. Department of Agriculture, Forest Service; U.S. Department of the Interior; The Nature Conservancy; Systems for Environmental Management (Producer). 119 p. Available: http://frames.nbii.gov/frcc/documents/FRCC_Guidebook_2008.07.10.pdf [2010, 3 May]. [70966]

97. Hansen, Paul L.; Pfister, Robert D.; Boggs, Keith; Cook, Bradley J.; Joy, John; Hinckley, Dan K. 1995. Classification and management of Montana's riparian and wetland sites. Miscellaneous Publication No. 54. Missoula, MT: The University of Montana, School of Forestry, Montana Forest and Conservation Experiment Station. 646 p. [24768]

98. Harper-Lore, Bonnie L. 2002. Invasive species and fence lines. In: Tellman, Barbara, ed. Invasive exotic species in the Sonoran region. Arizona-Sonora Desert Museum Studies in Natural History. Tucson, AZ: The University of Arizona Press; The Arizona-Sonora Desert Museum: 307-310. [48673]

99. Harrington, H. D. 1964. Manual of the plants of Colorado. 2nd ed. Chicago, IL: The Swallow Press. 666 p. [6851]

100. Harris, Richard W.; Leiser, Andrew T.; Fissell, Robert E. 1975. Plant tolerance to flooding. Summary report -- 1971-1975. Grant Contract No. A 5fs-16565; RWH-200-7/1/75. Davis, CA: University of California, Department of Environmental Horticulture. 30 p. In cooperation with: U.S. Army Corps of Engineers, U.S. Forest Service. [76584]

101. Harris, Stanley W.; Marshall, William H. 1963. Ecology of water-level manipulations on a northern marsh. Ecology. 44(2): 331-343. [17808]

102. Harrison, R. D.; Chatterton, N. J.; Page, R. J.; Curto, M.; Asay, K. H.; Jensen, K. B.; Horton, W. H. 1996. Competition, biodiversity, invasion, and wildlife use of selected introduced grasses in the Columbia and Great Basins. Research Report 155. Logan, UT: Utah State University, Utah Agricultural Experiment Station. 84 p. [67657]

103. Harty, Francis M.; Ver Steeg, Jeffrey M.; Heidorn, Randy R.; Harty, Lorree. 1991. Direct mortality and reappearance of small mammals in an Illinois grassland after a prescribed burn. Natural Areas Journal. 11(2): 114-119. [27665]

104. Hassien, Frederick D. 1994. SRM 802: Missouri prairie. In: Shiflet, Thomas N., ed. Rangeland cover types of the United States. Denver, CO: Society for Range Management: 111-112. [67469]

105. Henderson, Richard A. 1990. Controlling reed canary grass in a degraded oak savanna. Restoration & Management Notes. 8(2): 123-124. [13756]

106. Henderson, Richard A. 1991. Reed canary grass poses threat to oak savanna restoration and maintenance. Restoration & Management Notes. 9(1): 32. [15451]

107. Henderson, Richard A. 2003. Are there keystone plant species driving diversity in Midwest prairies? In: Fore, Stephanie, ed. Promoting prairie: Proceedings of the 18th North American prairie conference; 2002 June 23-27; Kirksville, MO. Kirksville, MO: Truman State University Press: 63-66. [67076]

108. Herr-Turoff, Andrea; Zedler, Joy B. 2007. Does morphological plasticity of the Phalaris arundinacea canopy increase invasiveness? Plant Ecology. 193: 265-277. [71272]

109. Herrick, Bradley M.; Wolf, Amy T. 2005. Invasive plant species in diked vs. undiked Great Lakes wetlands. Journal of Great Lakes Research. 31(3): 277-278. [68541]

110. Heutte, Tom; Bella, Elizabeth; Snyder, Jamie; Shephard, Michael. 2003. Invasive plants and exotic weeds of southeast Alaska, [Online]. In: Forest health protection--Alaska Region. In: Invasive plants. Anchorage, AK: U.S. Department of Agriculture, Forest Service, Alaska Region, State and Private Forestry, Forest Health Protection (Producer). Available: www.invasive.org/weedcd/pdfs/se_inv_plnt_guide1.pdf [2010, March 1]. [78986]

111. Hickman, James C., ed. 1993. The Jepson manual: Higher plants of California. Berkeley, CA: University of California Press. 1400 p. [21992]

112. Hitchcock, A. S. 1951. Manual of the grasses of the United States. Misc. Publ. No. 200. Washington, DC: U.S. Department of Agriculture, Agricultural Research Administration. 1051 p. [2nd edition revised by Agnes Chase in two volumes. New York: Dover Publications, Inc.]. [1165]

113. Hitchcock, C. Leo; Cronquist, Arthur; Ownbey, Marion. 1969. Vascular plants of the Pacific Northwest. Part 1: Vascular cryptogams, gymnosperms, and monocotyledons. Seattle, WA: University of Washington Press. 914 p. [1169]

114. Hoagstrom, Carl W.; Schetter, Timothy A.; Tumino, Lisa L. 1995. Effect of a prescribed burn on the small mammals of an old field in the prairie peninsula area of Ohio. In: Hartnett, David C., ed. Prairie biodiversity: Proceedings, 14th North American prairie conference; 1994 July 12-16; Manhattan, KS. Manhattan, KS: Kansas State University: 55-57. [28228]

115. Hobbs, Richard J.; Humphries, Stella E. 1995. An integrated approach to the ecology and management of plant invasions. Conservation Biology. 9(4): 761-770. [44463]

116. Hodgson, J. M. 1973. Differential response of ditchbank grasses to herbicides. Weed Science. 21(5): 421-423. [77361]

117. Hoffman, G. R.; Hogan, M. B.; Stanley, L. D. 1980. Germination of plant species common to reservoir shores in the northern Great Plains. Bulletin of the Torrey Botanical Club. 107(4): 506-513. [77365]

118. Hoffman, George R.; Shetron, Stephen G.; Klimas, Charles V.; Allen, Hollis H. 1986. Lakeshore vegetation, studies at Lake Oahe, South Dakota. Final report. Technical Report E-86-3. Vicksburg, MS: U.S. Army Engineer Waterways Experiment Station, Environmental Laboratory. [78218]

119. Hoffman, Randy; Kearns, Kelly, eds. 1997. Fact sheet: Reed canary grass (Phalaris arundinacea), [Online]. In: Wisconsin manual of control recommendations for ecologically invasive plants. In: Invasive species--Educational resources and publications. Madison, WI: Wisconsin Department of Natural Resources (Producer). Available: http://dnr.wi.gov/invasives/fact/reed_canary.htm [2010, March 11]. [79111]

120. Holland, Marjorie M.; Burk, C. John; McLain, David. 2000. Long-term vegetation dynamics of the lower strata of a western Massachusetts oxbow swamp forest. Rhodora. 102(910): 154-174. [40164]

121. Holt, Imy Vincent. 1954. Initiation and development of the inflorescences of Phalaris arundinacea L. and Dactylis glomeratea L. Iowa State College Journal of Science. 28(4): 630-621. [77615]

122. Houlahan, Jeff E.; Findlay, C. Scott. 2004. Effect of invasive plant species on temperate wetland plant diversity. Conservation Biology. 18(4): 1132-1138. [71345]

123. Hovick, Stephen M.; Reinartz, James A. 2005. Combination of treatments influence survival of

woody species planted to suppress reed canarygrass (Wisconsin). Ecological Restoration. 23(2): 126. [77438]

124. Howe, H. F.; Brown, J. S.; Zorn-Arnold, B. 2002. A rodent plague on prairie diversity. Ecology Letters. 5(1): 30-36. [48912]

125. Howe, Henry F. 1994. Managing species diversity in tallgrass prairie: assumptions and implications. Conservation Biology. 8(3): 691-704. [26692]

126. Howe, Henry F. 1994. Response of early- and late-flowering plants to fire season in experimental prairies. Ecological Applications. 4(1): 121-133. [27810]

127. Howe, Henry F. 1995. Succession and fire season in experimental prairie plantings. Ecology. 76(6): 1917-1925. [48450]

128. Howe, Henry F. 1999. Response of Zizia aurea to seasonal mowing and fire in a restored prairie. The American Midland Naturalist. 141(2): 373-380. [30533]

129. Howe, Henry F. 2000. Grass response to seasonal burns in experimental plantings. Journal of Range Management. 53(4): 437-441. [77370]

130. Huffman, Mary R.; Annala, Anne E.; Lattimore, Paul T.; Kapustka, Lawrence A. 1986. Prairie restorations in southwestern Ohio: vegetation and soil characteristics after ten years. In: Clambey, Gary K.; Pemble, Richard H., eds. The prairie: past, present and future: Proceedings of the 9th North American prairie conference; 1984 July 29 - August 1; Moorhead, MN. Fargo, ND: Tri-College University Center for Environmental Studies: 185-189. [3566]

131. Hulten, Eric. 1968. Flora of Alaska and neighboring territories. Stanford, CA: Stanford University Press. 1008 p. [13403]

132. Hunt, Robert L. 1979. Removal of woody streambank vegetation to improve trout habitat. Tech. Bull. No. 115. Madison, WI: Department of Natural Resources. 37 p. [13744]

133. Hutchison, Max. 1992. Vegetation management guideline: reed canary grass (Phalaris arundinacea L.). Natural Areas Journal. 12(3): 159. [19406]

134. Iannone, Basil V., III; Galatowitsch, Susan M. 2008. Altering light and soil N to limit Phalaris arundinacea reinvasion in sedge meadow restorations. Restoration Ecology. 16(4): 689-701. [78250]

135. Iannone, Basil V., III; Galatowitsch, Susan M.; Rosen, Carl J. 2008. Evaluation of resource-limiting strategies intended to prevent Phalaris arundinacea (reed canarygrass) invasions in restored sedge meadows. Ecoscience. 15(4): 508-518. [78249]

136. Ishida, Shinya; Nakashizuka, Tohru; Gonda, Yutaka; Kamitani, Tomohiko. 2008. Effects of flooding and artificial burning disturbances on plant species composition in a downstream riverside floodplain. Ecological Research. 23(4): 745-755. [75801]

137. Jenkins, Noah J.; Yeakley, J. Alan; Stewart, Elaine M. 2008. First-year responses to managed flooding of lower Columbia River bottomland vegetation dominated by Phalaris arundinacea. Wetlands. 28(4): 1018-1027. [78379]

138. Johnson, Douglas E. 1999. Surveying, mapping, and monitoring noxious weeds on rangelands. In: Sheley, Roger L.; Petroff, Janet K., eds. Biology and management of noxious rangeland weeds. Corvallis, OR: Oregon State University Press: 19-36. [35707]

139. Jung, Vincent; Hoffman, Lucien; Muller, Serge. 2009. Ecophysiological responses of nine floodplain meadow species to changing hydrological conditions. Plant Ecology. 201: 589-598. [74194]

140. Kantrud, Harold A.; Millar, John B.; van der Valk, A. G. 1989. Vegetation of wetlands of the prairie pothole region. In: van der Valk, Arnold, ed. Northern prairie wetlands. Ames, IA: Iowa State University Press: 132-187. [15217]

141. Kartesz, John T. 1999. A synonymized checklist and atlas with biological attributes for the vascular flora of the United States, Canada, and Greenland. 1st ed. In: Kartesz, John T.; Meacham, Christopher A. Synthesis of the North American flora (Windows Version 1.0), [CD-ROM]. Chapel Hill, NC: North Carolina Botanical Garden (Producer). In cooperation with: The Nature Conservancy; U.S. Department of Agriculture, Natural Resources Conservation Service; U.S. Department of the Interior, Fish and Wildlife Service. [36715]

142. Kartesz, John Thomas. 1988. A flora of Nevada. Reno, NV: University of Nevada. 1729 p. [In 2 volumes]. Dissertation. [42426]

143. Kearney, Thomas H.; Peebles, Robert H.; Howell, John Thomas; McClintock, Elizabeth. 1960. Arizona flora. 2nd ed. Berkeley, CA: University of California Press. 1085 p. [6563]

144. Kellogg, Chev H.; Bridgham, Scott D. 2002. Colonization during early succession of restored freshwater marshes. Canadian Journal of Botany. 80(2): 176-204. [42160]

145. Kercher, Suzanne M.; Carpenter, Quentin J.; Zedler, Joy B. 2004. Interrelationships of hydrologic disturbance, reed canary grass (Phalaris arundinacea L.), and native plants in Wisconsin wet meadows. Natural Areas Journal. 24(4): 316-325. [68731]

146. Kercher, Suzanne M.; Herr-Turoff, Andrea; Zedler, Joy B. 2007. Understanding invasion as a process: the case of Phalaris arundinacea in wet prairies. Biological Invasions. 9: 657-665. [71238]

147. Kercher, Suzanne M.; Zedler, Joy B. 2004. Multiple disturbances accelerate invasion of reed canary grass (Phalaris arundinacea L.) in a mesocosm study. Oecologia. 138(3): 455-464. [47458]

148. Kilbride, Kevin M.; Paveglio, Fred L. 1999. Integrated pest management to control reed canarygrass in seasonal wetlands of southwestern Washington. Wildlife Society Bulletin. 27(2): 292-297. [77394]

149. Kim, Kee Dae; Ewing, Kern; Giblin, David E. 2006. Controlling Phalaris arundinacea (reed canarygrass) with live willow stakes: a density-dependent response. Ecological Engineering. 27(3): 219-227. [78253]

150. Kindscher, Kelly; Holah, Jenny. 1998. An old-growth definition for western hardwood gallery forests. Gen. Tech. Rep. SRS-22. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 12 p. [50216]

151. Kirsch, Eileen M.; Gray, Brian R.; Fox, Timothy J.; Thogmartin, Wayne E. 2007. Breeding bird territory placement in riparian wet meadows in relation to invasive reed canary grass, Phalaris arundinacea. Wetlands. 27(3): 644-655. [78252]

152. Klebesadel, Leslie J.; Dofing, Stephen M. 1991. Reed canarygrass in Alaska: influence of latitude-of-adaptation on winter survival and forage productivity, and observations on seed productivity. Bulletin 84. Fairbanks, AK: University of Alaska, School of Agriculture and Land Resources Management, Agricultural and Forestry Experiment Station. 24 p. [19473]

153. Klimesova, Jitka. 1994. The effects of timing and duration of floods on growth of young plants of Phalaris arundinacea and Urtica dioica: an experimental study. Aquatic Botany. 48: 21-29. [78380]

154. Klimesova, Jitka; Srutek, Miroslav. 1995. Vertical distribution of underground organs of Phalaris arundinacea and Urtica dioica in a floodplain: a comparison of two methods. Preslia. 67(1): 47-53. [78263]

155. Kline, Virginia M. 1992. Henry Green's remarkable prairie. Restoration & Management Notes. 10(1): 36-37. [19431]

156. Klinka, Karel; Qian, Hong; Pojar, Jim; Meidinger, Del V. 1996. Classification of natural forest communities of coastal British Columbia, Canada. Vegetatio. 125: 149-168. [28530]

157. Klopatek, Jeffrey M.; Stearns, Forest W. 1978. Primary productivity of emergent macrophytes in a Wisconsin freshwater marsh ecosystem. The American Midland Naturalist. 100(2): 320-332. [77363]

158. Knight, Dennis H.; Jones, George P.; Akashi, Yoshiko; Myers, Richard W. 1987. Vegetation ecology in the Bighorn Canyon National Recreation Area: Wyoming and Montana. Final Report. Laramie, WY: University of Wyoming; National Park Service Research Center. 114 p. [12498]

159. Kovalchik, Bernard L.; Clausnitzer, Rodrick R. 2004. Classification and management of aquatic, riparian, and wetland sites on the national forests of eastern Washington: series description. Gen. Tech. Rep. PNW-GTR-593. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 354 p. [53329]

160. Kucera, C. L. 1992. Tall-grass prairie. In: Coupland, R. T., ed. Natural grasslands--A. Introduction and Western Hemisphere. Ecosystems of the World 8A. Amsterdam, The Netherlands: Elsevier Science Publishers B. V.: 227-268. [23827]

161. Kurtz, Carl. 2003. Reed canary grass control (displacement by a diverse native-species mix). In: Fore, Stephanie, ed. Promoting prairie: Proceedings of the 18th North American prairie conference; 2002 June 23-27; Kirksville, MO. Kirksville, MO: Truman State University Press: 136-137. [67087]

162. LANDFIRE Rapid Assessment. 2005. Reference condition modeling manual (Version 2.1), [Online]. In: LANDFIRE. Cooperative Agreement 04-CA-11132543-189. Boulder, CO: The Nature Conservancy; U.S. Department of Agriculture, Forest Service; U.S. Department of the Interior (Producers). 72 p. Available: http://www.landfire.gov/downloadfile.php?file=RA_Modeling_Manual_v2_1.pdf [2007, May 24]. [66741]

163. LANDFIRE Rapid Assessment. 2007. Rapid assessment reference condition models, [Online]. In: LANDFIRE. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Lab; U.S. Geological Survey; The Nature Conservancy (Producers). Available: http://www.landfire.gov/models_EW.php [2008, April 18] [66533]

164. Landin, Mary C. 1979. The importance of wetlands in the north central and northeast United States to non-game birds. In: DeGraaf, Richard M.; Evans, Keith E., compilers. Proceedings of the workshop: Management of northcentral and northeastern forests for nongame birds; 1979 January 23-25; Minneapolis, MN. Gen. Tech. Rep. NC-51. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station: 179-188. [18087]

165. Landraff, Asbjorn; Junttila, Olavi. 1979. Germination and dormancy of reed canary-grass seeds (Phalaris arundinacea). Physiologia Plantarum. 45(1): 96-102. [78261]

166. Larter, Nicholas C.; Gates, Cormack C. 1991. Diet and habitat selection of wood bison in relation to seasonal changes in forage quantity and quality. Canadian Journal of Zoology. 69: 2677-2685. [24528]

167. Lavergne, Sebastien; Molofsky, J. 2004. Reed canary grass (Phalaris arundinacea) as a biological model in the study of plant invasion. Critical Reviews in Plant Sciences. 23(5): 415-429. [78421]

168. Lavergne, Sebastien; Molofsky, Jane. 2006. Control strategies for the invasive reed canarygrass (Phalaris arundinacea L.) in North American wetlands: the need for an integrated management plan. Natural Areas Journal. 26(2): 208-214. [75518]

169. Lavergne, Sebastien; Molofsky, Jane. 2007. Increased genetic variation and evolutionary potential drive the success of an invasive grass. Proceedings, National Academy of Science. 104(10): 3883-3888. [77960]

170. Lavoie, Claude; Dufresne, Caroline. 2005. The spread of reed canarygrass (Phalaris arundinacea) in Quebec: a spatio-temporal perspective. Ecoscience. 12(3): 366-375. [78255]

171. Leck, Mary A.; Simpson, Robert L. 1993. Seeds and seedlings of the Hamilton Marshes, a Deleware River tidal freshwater wetland. Proceedings of the Academy of Natural Sciences of Philadelphia. 144: 267-281. [68544]

172. Leck, Mary A.; Simpson, Robert L. 1994. Tidal freshwater wetland zonation: seed and seedling dynamics. Aquatic Botany. 47: 61-75. [77963]

173. Leck, Mary Allessio. 1996. Germination of macrophytes from a Delaware River tidal freshwater wetland. Bulletin of the Torrey Botanical Club. 123(1): 48-67. [77414]

174. Leck, Mary Allessio. 2003. Seed-bank and vegetation development in a created tidal freshwater wetland on the Delaware River, Trenton, New Jersey, USA. Wetlands. 23(2): 310-343. [70387]

175. Leck, Mary Allessio; Leck, Charles F. 2005. Vascular plants of a Delaware River tidal freshwater wetland and adjacent terrestrial areas: seed bank and vegetation comparisons of reference and constructed marshes and annotated species list. Journal of the Torrey Botanical Society. 132(2): 323-354. [60627]

176. Lesica Peter. 1997. Spread of Phalaris arundinacea adversely impacts the endangered plant Howellia aquatilis. Great Basin Naturalist. 57(4): 366-368. [78257]

177. Lesica, Peter; Martin, Brian. 2004. Study evaluates methods for controlling reed canarygrass in sedge meadows (Montana). Ecological Restoration. 22(3): 227-228. [69932]

178. Lindig-Cisneros, Roberto; Zedler, Joy B. 2002. Phalaris arundinacea seedling establishment: effects of canopy complexity in fen, mesocosm, and restoration experiments. Canadian Journal of Botany. 80: 617-624. [42139]

179. Lindig-Cisneros, Roberto; Zedler, Joy B. 2002. Relationships between canopy complexity and germination microsites for Phalaris arundinacea L. Oecologia. 133(2): 159-167. [77332]

180. Lindig-Cisneros, Roberto; Zedler, Joy. 2001. Effect of light on seed germination in Phalaris arundinacea L. (reed canary grass). Plant Ecology. 155(1): 75-78. [77299]

181. Littlefield, Carroll D. 1999. Greater sandhill crane productivity on privately owned wetlands in eastern Oregon. Western Birds. 30(4): 206-210. [74615]

182. Long, Colin J.; Whitlock, Cathy. 2002. Fire and vegetation history from the coastal rain forest of the western Oregon Coast Range. Quaternary Research. 58: 215-225. [45956]

183. Lugo, Ariel E. 1995. Fire and wetland management. In: Cerulean, Susan I.; Engstrom, R. Todd, eds. Fire in wetlands: a management perspective: Proceedings, 19th Tall Timbers fire ecology conference; 1993 November 3-6; Tallahassee, FL. No. 19. Tallahassee, FL: Tall Timbers Research Station: 1-9. [25770]

184. Lyons, Kelly E. 2003. Element stewardship abstract: Phalaris arundinacea L.--Reed canarygrass, [Online]. In: Control methods--Invasive plant management. In: GIST (Global Invasive Species Team). Arlington, VA: The Nature Conservancy (Producer). Available: http://www.invasive.org/weedcd/pdfs/tncweeds/phalaru.pdf [2010, April 16]. [72493]

185. Mack, R. N. 1986. Alien plant invasion into the Intermountain West: A case history. In: Mooney, Harold A.; Drake, James A., eds. Ecology of biological invasions of North America and Hawaii. Ecological Studies 58. New York: Springer-Verlag: 191-213. [17516]

186. Mack, Richard N.; Simberloff, Daniel; Lonsdale, W. Mark; Evans, Harry; Clout, Michael; Bazzaz, Fakhri A. 2000. Biotic invasions: causes, epidemiology, global consequences, and control. Ecological Applications. 10(3): 689-710. [48324]

187. Magee, Dennis W.; Ahles, Harry E. 2007. Flora of the Northeast: A manual of the vascular flora of New England and adjacent New York. 2nd ed. Amherst, MA: University of Massachusetts Press. 1214 p. [74293]

188. Magee, Teresa K.; Ernst, Ted L.; Kentula, Mary E.; Dwire, Kathleen A. 1999. Floristic comparison of freshwater wetlands in an urbanizing environment. Wetlands. 19: 517-534. [78298]

189. Marks, J. B. 1942. Land use and plant succession in Coon Valley, Wisconsin. Ecological Monographs. 12(2): 113-133. [63597]

190. Marten, G. C. 1985. Reed canarygrass. In: Heath, Maurice E.; Barnes, Robert F.; Metcalfe, Darrel S., eds. Forages: The science of grassland agriculture. 4th ed. Ames, IA: Iowa State University Press: 207-216. [78985]

191. Martin, Alexander C.; Zim, Herbert S.; Nelson, Arnold L. 1951. American wildlife and plants. New York: McGraw-Hill Book Company. 500 p. [4021]

192. Martin, William C.; Hutchins, Charles R. 1981. A flora of New Mexico. Volume 2. Germany: J. Cramer. 2589 p. [37176]

193. Martina, Jason P.; von Ende, Carl N. 2008. Correlation of soil nutrient characteristics and reed canarygrass (Phalaris arundinacea: Poaceae) abundance in northern Illinois (USA). The American Midland Naturalist. 160(2): 430-437. [73221]

194. Mason, Herbert L. 1957. A flora of the marshes of California. Berkeley, CA: University of California Press. 878 p. [16905]

195. Maurer, Debbie A.; Lindig-Cisneros, Roberto; Werner, Katherine J.; Kercher, Suzanne; Miller, Rebecca; Zedler, Joy B. 2003. The replacement of wetland vegetation by reed canarygrass (Phalaris arundinacea). Ecological Restoration. 21(2): 116-119. [77613]

196. Maurer, Deborah A.; Zedler, Joy B. 2002. Differential invasion of a wetland grass explained by tests of nutrients and light availability on establishment and clonal growth. Oecologia. 131(2): 279-288. [77359]

197. McCain, Cindy; Christy, John A. 2005. Field guide to riparian plant communities in northwestern Oregon. Tech. Pap. R6-NR-ECOL-TP-01-05. [Portland, OR]: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region. 357 p. [63114]

198. McElgunn, J. D. 1974. Germination response of forage grasses to constant and alternating temperatures. Canadian Journal of Plant Science. 54: 265-270. [77961]

199. McKenzie, R. E. 1951. The ability of forage plants to survive early spring flooding. Scientific

Agriculture. 31: 358-367. [78214]

200. McWilliams, Scott R.; Sloat, Todd; Toft, Catherine A.; Hatch, Daphne. 2007. Effects of prescribed fall burning on a wetland plant community, with implications for management of plants and herbivores. Western North American Naturalist. 67(2): 299-317. [67951]

201. Mehrhoff, L. J.; Silander, J. A., Jr.; Leicht, S. A.; Mosher, E. S.; Tabak, N. M. 2003. IPANE: Invasive Plant Atlas of New England, [Online]. Storrs, CT: University of Connecticut, Department of Ecology and Evolutionary Biology (Producer). Available: http://nbii-nin.ciesin.columbia.edu/ipane/ [2008, May 28]. [70356]

202. Meisel, Jennifer; Trushenski, Nicole; Weiher, Evan. 2002. A gradient analysis of oak savanna community composition in western Wisconsin. Journal of the Torrey Botanical Society. 129(2): 115-124. [77952]

203. Menges, Eric S.; Waller, Donald M. 1983. Plant strategies in relation to elevation and light in floodplain herbs. American Naturalist. 122(4): 454-473. [42191]

204. Merigliano, Michael F. 1996. Ecology and management of the South Fork Snake River cottonwood forest. Tech. Bulletin 96-9. Boise, ID: U.S. Department ot the Interior, Bureau of Land Management, Idaho State Office. 79 p. [27350]

205. Merigliano, Michael F.; Lesica, Peter. 1998. The native status of reed canary grass (Phalaris arundinacea L.) in the Inland Northwest, USA. Natural Areas Journal. 18(3): 223-230. [77608]

206. Miletti, Tara E.; Carlyle, Cameron N.; Picard, Christian R.; Mulac, Kathleen M.; Landaw, Adam; Fraser, Lauchlan H. 2005. Hydrology, water chemistry, and vegetation characteristics of a tamarack bog in Bath Township, Ohio: towards restoration and enhancement. Ohio Journal of Science. 105(2): 21-30. [71351]

207. Miller, Gary L. 1977. Early plant succession on a dredging spoils island in the Seneca River of upstate New York. Bulletin of the Torrey Botanical Club. 104(4): 386-391. [73112]

208. Miller, Melanie. 2000. Fire autecology. In: Brown, James K.; Smith, Jane Kapler, eds. Wildland fire in ecosystems: Effects of fire on flora. Gen. Tech. Rep. RMRS-GTR-42-vol. 2. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 9-34. [36981]

209. Miller, Rebecca C.; Zedler, Joy B. 2003. Responses of native and invasive wetland plants to hydroperiod and waterdepth. Plant Ecology. 167(1): 57-69. [77345]

210. Miller, Timothy W.; Martin, Laura Potash; MacConnell, Craig B. 2008. Managing reed canarygrass (Phalaris arundinacea) to aide in revegetation of riparian buffers. Weed Technology. 22: 507-513. [72489]

211. Mills, Jason E.; Reinartz, James A.; Meyer, Gretchen A.; Young, Erica B. 2009. Exotic shrub invasion in an undisturbed wetland has little community-level effect over a 15-year period. Biological Invasions. 11(8): 1803-1820. [74265]

212. Mitich, Larry W. 1999. Intriguing world of weeds: Purple loosestrife, Lythrum salicaria L. Weed Technology. 13(4): 843-846. [37511]

213. Moffatt, S. F.; McLachlan, S. M. 2004. Understorey indicators of disturbance for riparian forests along an urban--rural gradient in Manitoba. Ecological Indicators. 4: 1-16. [51154]

214. Mohlenbrock, Robert H. 1986. [Revised edition]. Guide to the vascular flora of Illinois. Carbondale, IL: Southern Illinois University Press. 507 p. [17383]

215. Monsen, Stephen B.; Stevens, Richard; Shaw, Nancy. 2004. Grasses. In: Monsen, Stephen B.; Stevens, Richard; Shaw, Nancy L., comps. Restoring western ranges and wildlands. Gen. Tech. Rep. RMRS-GTR-136-vol-2. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 295-424. [52841]

216. Morin, Edith; Bouchard, Andre; Jutras, Pierre. 1989. Ecological analysis of disturbed riverbanks in the Montreal area of Quebec. Environmental Management. 13(2): 215-225. [13233]

217. Morrison, Shannon L.; Molofsky, Jane. 1998. Effects of genotypes, soil moisture, and competition on the growth of an invasive grass, Phalaris arundinacea (reed canary grass). Canadian Journal of Botany. 76(11): 1939-1946. [38119]

218. Morrison, Shannon L.; Molofsky, Jane. 1999. Environmental and genetic effects on the early survival and growth of the invasive grass Phalaris arundinacea. Canadian Journal of Botany. 77: 1447-1453. [78260]

219. Mueller, Irene M. 1941. An experimental study of rhizomes of certain prairie plants. Ecological Monographs. 11: 165-188. [25837]

220. Muldavin, Esteban; Durkin, Paula; Bradley, Mike; Stuever, Mary; Mehlhop, Patricia. 2000. Handbook of wetland vegetation communities of New Mexico. Volume 1: classification and community descriptions. Albuquerque, NM: University of New Mexico, Biology Department; New Mexico Natural Heritage Program. 172 p. [+ appendices]. [45517]

221. Mulhouse, John M.; Galatowitsch, Susan M. 2003. Revegetation of prairie pothole wetlands in the mid-continental United States: twelve years post-reflooding. Plant Ecology. 169(2): 143-159. [52957]

222. Munz, Philip A.; Keck, David D. 1973. A California flora and supplement. Berkeley, CA: University of California Press. 1905 p. [6155]

223. Narumalani, Sunil; Mishra, Deepak R.; Wilson, Robert; Reece, Patrick; Kohler, Ann. 2009. Detecting and mapping four invasive species along the floodplain of North Platte River, Nebraska. Weed Technology. 23: 99-107. [74187]

224. NatureServe. 2009. Comprehensive report: Phalaris arundinacea--reed canarygrass, [Online]. In: NatureServe Explorer NatureServe Explorer: An online encyclopedia of life. Version 7.1. Arlington, VA: NatureServe (Producer). Available: http://www.natureserve.org/explorer/servlet/NatureServe?loadTemplate= tabular_report.wmt&paging=home&save=all&sourceTemplate=reviewMiddle .wmt [2010, March 11]. [79112]

225. Neiland, Bonita Miller; Curtis, John T. 1956. Differential responses to clipping of six prairie grasses in Wisconsin. Ecology. 37(2): 355-365. [37219]

226. Nelson, Linda S.; Getsinger, K. D.; Freedman, J. E. 1996. Efficacy of triclopyr on purple loosestrife and associated wetland vegetation. Journal of Aquatic Plant Management. 34: 72-74. [37507]

227. Niemuth, Neal D. 2000. Land use and vegetation associated with greater prairie-chicken leks in an agricultural setting. Journal of Wildlife Management. 64(1): 278-286. [33782]

228. Odland, Arvid; del Moral, Roger. 2002. Thirteen years of wetland vegetation succession following a permanent drawdown, Myrkdalen Lake, Norway. Plant Ecology. 162(2): 185-198. [77407]

229. Odum, William; Smith, Thomas J., III; Hoover, John K.; McIvor, Carole C. 1984. The ecology of tidal freshwater marshes of the United States east coast: a community profile. FWS/OBS-83/17. Washington, DC: U.S. Department of the Interior, Fish and Wildlife Service. 177 p. [50158]

230. Osterm, Liv. 1987. Studies on genetic variation in reed canarygrass, Phalaris arundinacea. I. Alkoloid type and concentration. Hereditas. 107: 235-248. [78375]

231. Padgett, Wayne G.; Youngblood, Andrew P.; Winward, Alma H. 1989. Riparian community type classification of Utah and southeastern Idaho. R4-Ecol-89-01. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Region. 191 p. [11360]

232. Paveglio, Fred L.; Kilbride, Kevin M. 2000. Response of vegetation to control of reed canarygrass in seasonally managed wetlands of southwestern Washington. Wildlife Society Bulletin. 28(3): 730-740. [77392]

233. Penfound, W. T.; Hathaway, Edward S. 1938. Plant communities in the marshlands of southeastern Louisiana. Ecological Monographs. 8(1): 3-56. [15089]

234. Perkins, Thais E.; Wilson, Mark V. 2005. The impacts of Phalaris arundinacea (reed canarygrass) invasion on wetland plant richness in the Oregon Coast Range, USA depend on beavers. Biological Conservation. 124(2): 291-295. [52860]

235. Perles, Stephanie J.; Podniesinski, Gregory S.; Eastman, E.; Sneddon, Lesley A.; Gawler, Sue C. 2007. Classification and mapping of vegetation and fire fuel models at Delaware Water Gap National Recreation Area: Volume 1 of 2, [Online]. Technical Report NPS/NER/NRTR2007/076. Philadelphia, PA: U.S. Department of the Interior, National Park Service, Northeast Region, Natural Resource Stewardship and Science. 187 p. Available: http://www.nps.gov/nero/science/FINAL/DEWA_veg_map/DEWA_veg_map.htm [2010, March 3]. [78999]

236. Perry, Laura G.; Galatowitsch, Susan M. 2004. The influence of light availability on competition between Phalaris arundinacea and a native wetland sedge. Plant Ecology. 170(1): 73-81. [77300]

237. Perry, Laura G.; Galatowitsch, Susan M.; Rosen, Carl J. 2004. Competitive control of invasive vegetation: a native wetland sedge suppresses Phalaris arundinacea in carbon-enriched soil. Journal of Applied Ecology. 41: 151-162. [48538]

238. Pojar, Jim; MacKinnon, Andy, eds. 1994. Plants of the Pacific Northwest coast: Washington, Oregon, British Columbia and Alaska. Redmond, WA: Lone Pine Publishing. 526 p. [25159]

239. Prach, Karel. 2003. Spontaneous succession in central-European man-made habitats: what information can be used in restoration practice? Applied Vegetation Science. 6: 125-129. [74754]

240. Preuninger, Jill S.; Umbanhowar, Charles, E., Jr. 1994. Effects of burning, cutting, and spraying on reed canary grass studied (Minnesota). Restoration & Management Notes. 12(2): 207. [50411]

241. Radford, Albert E.; Ahles, Harry E.; Bell, C. Ritchie. 1968. Manual of the vascular flora of the Carolinas. Chapel Hill, NC: The University of North Carolina Press. 1183 p. [7606]

242. Raunkiaer, C. 1934. The life forms of plants and statistical plant geography. Oxford: Clarendon Press. 632 p. [2843]

243. Reid, M.; Schulz, K.; Schindel, M.; Comer, P.; Kittel, G.; [and others], compilers. 2000. International classification of ecological communities: Terrestrial vegetation of the western United States--Chihuahuan Desert subset. Report from Biological Conservation Datasystem and working draft of April 23, 2000. Boulder, CO: Association for Biodiversity Information/The Nature Conservancy, Community Ecology Group. 154 p. In: Southwestern Regional Gap Analysis Project. New Mexico Cooperative Fish and Wildlife Research Unit (Producer). Available: http://fws-nmcfwru.nmsu.edu/swregap/nm/Chihuahua.pdf [2005, May 6]. [52906]

244. Reschke, Carol. 1990. Ecological communities of New York State. Latham, NY: New York State Department of Environmental Conservation, Natural Heritage Program. 96 p. [21441]

245. Reuter, D. Dayton. 1986. Effects of prescribed burning, cutting and torching on shrubs in a sedge meadow wetland. In: Koonce, Andrea L., ed. Prescribed burning in the Midwest: state-of-the-art: Proceedings of a symposium; 1986 March 3-6; Stevens Point, WI. Stevens Point, WI: University of Wisconsin, College of Natural Resources, Fire Science Center: 108-115. [16278]

246. Reuter, D. Dayton. 1986. Sedge meadows of the Upper Midwest: a stewardship summary. Natural Areas Journal. 6(4): 27-34. [20295]

247. Rice, J. S.; Pinkerton, B. W. 1993. Reed canarygrass survival under cyclic inundation. Journal of Soil and Water Conservation. 48(2): 132-135. [21131]

248. Ringold, Paul L.; Magee, Teresa K.; Peck, David V. 2008. Twelve invasive plant taxa in US western riparian ecosystems. Journal of the North American Benthological Society. 27(4): 949-966. [73064]

249. Robertson, Morgan M. 1997. Prescribed burning as a management and restoration tool in wetlands of the upper Midwest, [Online]. In: Restoration and Reclamation Review: Student On-line Journal. 2(4). St. Paul, MN: University of Minnesota, Department of Horticultural Science (Producer). Available: http://conservancy.umn.edu/bitstream/58825/1/2.4.Robertson.pdf [2010, August 3]. [68900]

250. Roland, A. E.; Smith, E. C. 1969. The flora of Nova Scotia. Halifax, NS: Nova Scotia Museum. 746 p. [13158]

251. Rosburg, Thomas R. 2001. Iowa's non-native graminoids. Journal of the Iowa Academy of Science. 108(4): 142-153. [47653]

252. Rydberg, P. A. 1915. Phytogeographical notes on the Rocky Mountain region. V. Grasslands of the subalpine and montane zones. Bulletin of the Torrey Botanical Club. 42(11): 629-642. [60596]

253. Rydberg, P. A.; Shear, C. L. 1897. A report upon the grasses and forage plants of the Rocky Mountain Region. Bulletin No. 5. Washington, DC: U.S. Department of Agriculture, Division of Agrostology. 48 p. [5497]

254. Sachs, A. P. W.; Coulman, B. E. 1983. Variability in reed canarygrass collections from eastern Canada. Crop Science. 23: 1041-1044. [78224]

255. Schneider, Rick E.; Faber-Langendoen, Don; Crawford, Rex C.; Weakley, Alan S. 1997. The status of biodiversity in the Great Plains: Great Plains vegetation classification--Supplemental Document 1, [Online]. In: Ostlie, Wayne R.; Schneider, Rick E.; Aldrich, Janette Marie; Faust, Thomas M.; McKim, Robert L. B.; Chaplin, Stephen J., comps. The status of biodiversity in the Great Plains. Arlington, VA: The Nature Conservancy, Great Plains Program (Producer). 75 p. [Cooperative Agreement # X 007803-01-3]. Available: http://conserveonline.org/docs/2005/02/greatplains_vegclass_97.pdf [2006, May 16]. On file with: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, Missoula, MT. [62020]

256. Schooler, Shon S.; McEvoy, Peter B.; Coombs, Eric M. 2006. Negative per capita effects of purple loosestrife and reed canary grass on plant diversity of wetland communities. Diversity and Distributions. 12(4): 351-363. [77426]

257. Sheaffer, Craig C.; Marten, Gordon C. 1995. Reed canarygrass. In: Barnes, Robert F.; Miller, Darrell A.; Nelson, C. Jerry, eds. Forages. Volume 1: An introduction to grassland agriculture. 5th ed. Ames, IA: Iowa State University Press: 335-343. [45330]

258. Sheley, Roger; Manoukian, Mark; Marks, Gerald. 1999. Preventing noxious weed invasion. In: Sheley, Roger L.; Petroff, Janet K., eds. Biology and management of noxious rangeland weeds. Corvallis, OR: Oregon State University Press: 69-72. [35711]

259. Shipley, B.; Parent, M. 1991. Germination responses of 64 wetland species in relation to seed size, minimum time to reproduction and seedling relative growth rate. Functional Ecology. 5(1): 111-118. [14554]

260. Simpson, Thomas B. 2009. Restoring native sedge meadow vegetation with a combination of herbicides (Illinois). Ecological Restoration. 27(2): 134-136. [75414]

261. Slinkard, A. E.; Nurmi, E. O.; Schwendiman, J. L. 1970. Seeding burned-over lands in northern Idaho. Current Information Series No. 139. Moscow, ID: University of Idaho, College of Agriculture, Cooperative Extension Service; Agricultural Experiment Station. 4 p. [19669]

262. Snyder, Ellen J.; Best, Louis B. 1988. Dynamics of habitat use by small mammals in prairie communities. The American Midland Naturalist. 119(1): 128-136. [3654]

263. Solecki, Mary Kay. 1997. Controlling invasive plants. In: Packard, Stephen; Mutel, Cornelia F., eds. The tallgrass restoration handbook: For prairies, savannas, and woodlands. Washington, DC: Island Press: 251-278. [43127]

264. Steiger, T. L. 1930. Structure of prairie vegetation. Ecology. 11(1): 170-217. [3777]

265. Stevens, O. A. 1921. Plants of Fargo, North Dakota, with dates of flowering. The American Midland Naturalist. 7(4/5): 135-156. [63630]

266. Stevens, O. A. 1957. Weights of seeds and numbers per plant. Weeds. 5: 46-55. [44071]

267. Stickney, Peter F. 1989. Seral origin of species comprising secondary plant succession in Northern Rocky Mountain forests. FEIS workshop: Postfire regeneration. Unpublished draft on file at: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, Missoula, MT. 10 p. [20090]

268. Strausbaugh, P. D.; Core, Earl L. 1977. Flora of West Virginia. 2nd ed. Morgantown, WV: Seneca Books, Inc. 1079 p. [23213]

269. Stubbendieck, James; Coffin, Mitchell J.; Landholt, L. M. 2003. Weeds of the Great Plains. 3rd ed. Lincoln, NE: Nebraska Department of Agriculture, Bureau of Plant Industry. 605 p. In cooperation with: University of Nebraska, Lincoln. [50776]

270. Suring, Lowell H.; Vohs, Paul A., Jr. 1979. Habitat use by Columbian white-tailed deer. Journal of Wildlife Management. 43(3): 610-619. [37245]

271. Swink, Floyd A. 1974. Plants of the Chicago region: a checklist of the vascular flora of the Chicago region, with notes on local distribution and ecology. 2nd ed. Lisle, IL: Morton Arboretum. 474 p. [75694]

272. Takos, Michael J. 1947. A semi-quantitative study of muskrat food habits. Journal of Wildlife Management. 11(4): 331-339. [67566]

273. Thompson, K.; Grime, J. P.; Mason, G. 1977. Seed germination in response to diurnal fluctuations of temperature. Nature. 267: 147-169. [72728]

274. Thysell, David R.; Carey, Andrew B. 2001. Quercus garryana communities in the Puget Trough, Washington. Northwest Science. 75(3): 219-235. [40763]

275. Toepfer, John E.; Eng, Robert L. 1988. Winter ecology of the greater prairie chicken. In: Bjugstad, Ardell J., technical coordinator. Prairie chickens on the Sheyenne National Grasslands: Symposium proceedings; 1987 September 18; Crookston, MN. Gen. Tech. Rep. RM-159. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 32-48. [5201]

276. Toole, E. H.; Brown, E. 1946. Final results of the Duvel buried seed experiment. Journal of Agricultural Research. 72: 201-210. [70349]

277. Tu, Mandy. 2004. Reed canarygrass (Phalaris arundinacea L.) control and management in the Pacific Northwest, [Online]. In: Control methods--Plant management resources. In: Invasives on the web: The global invasive species team (GIST). Arlington, VA: The Nature Conservancy (Producer). Available: http://www.invasive.org/gist/moredocs/phaaru01.pdf [2010, March 12]. [79113]

278. Tu, Mandy; Hurd, Callie; Randall, John M., eds. 2001. Weed control methods handbook: tools and techniques for use in natural areas. Davis, CA: The Nature Conservancy. 194 p. [37787]

279. Tu, Mandy; Salzer, Dan. 2005. Evaluation of integrated management techniques for controlling reed canarygrass (Oregon). Ecological Restoration. 23(2): 127-129. [77447]

280. Tyser, Robin W.; Worley, Christopher A. 1992. Alien flora in grasslands adjacent to road and trail corridors in Glacier National Park, Montana (U.S.A.). Conservation Biology. 6(2): 253-262. [19435]

281. U.S. Department of Agriculture, Forest Service. 2001. Guide to noxious weed prevention practices. Washington, DC: U.S. Department of Agriculture, Forest Service. 25 p. Available online: http://www.fs.fed.us/invasivespecies/documents/FS_WeedBMP_2001.pdf [2009, November 19]. [37889]

282. U.S. Department of Agriculture, Natural Resources Conservation Service. 2010. PLANTS Database, [Online]. Available: http://plants.usda.gov/. [34262]

283. U.S. Department of Agriculture. 1948. Grass: The yearbook of agriculture 1948. Washington, DC. 892 p. [2391]

284. van der Valk, A. G.; Bliss, L. C. 1971. Hydrarch succession and net primary production of oxbow lakes in central Alberta. Canadian Journal of Botany. 49(7): 1177-1199. [3244]

285. Vecrin, M. P.; Grevilliot, F.; Muller, S. 2007. The contribution of persistent soil seed banks and flooding to the restoration of alluvial meadows. Journal for Nature Conservation. 15(1): 59-69. [67387]

286. Vervuren, P. J. A.; Beurskens, S. M. J. H.; Blom, C. W. P. M. 1999. Light acclimation, CO2 response and long-term capacity of underwater photosynthesis in three terrestrial plant species. Plant, Cell and Environment. 22(8): 959-968. [78436]

287. Vincent, Gilles; Bergeron, Yves; Meilleur, Alain. 1986. Plant community pattern analysis: a cartographic approach applied in the Lac des Deux-Montagnes area (Quebec). Canadian Journal of Botany. 64: 326-335. [16948]

288. Vivian-Smith, Gabrielle; Stiles, Edmund W. 1994. Dispersal of salt marsh seeds on the feet and feathers of waterfowl. Wetlands. 14(4): 316-319. [60215]

289. Vose, P. B. 1962. Delayed germination in reed canarygrass, Phalaris arundinacea L. Annals of Botany. 26(102): 197-206. [77621]

290. Voss, Edward G. 1972. Michigan flora. Part I: Gymnosperms and monocots. Bulletin 55. Bloomfield Hills, MI: Cranbrook Institute of Science; Ann Arbor, MI: University of Michigan Herbarium. 488 p.

[11471]

291. Wade, Dale D.; Brock, Brent L.; Brose, Patrick H.; Grace, James B.; Hoch, Greg A.; Patterson, William A., III. 2000. Fire in eastern ecosystems. In: Brown, James K.; Smith, Jane Kapler, eds. Wildland fire in ecosystems: Effects of fire on flora. Gen. Tech. Rep. RMRS-GTR-42-vol. 2. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 53-96. [36983]

292. Wakimoto, Ronald H.; Willard, E. Earl. 1991. Monitoring post-fire vegetation recovery in ponderosa pine and sedge meadow communities in Glacier National Park, NW Montana. Progress report: Research Joint Venture Agreement INT-89441. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 17 p. Unpublished report on file with: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, Missoula, MT; FEIS files. [17635]

293. Walters, Gary L.; Williams, Charles E. 1999. Riparian forest overstory and herbaceous layer of two upper Allegheny River islands in northwestern Pennsylvania. Castanea. 64(1): 81-89. [37387]

294. Weaver, J. E. 1960. Flood plain vegetation of the central Missouri Valley and contacts of woodland with prairie. Ecological Monographs. 30(1): 37-64. [275]

295. Weber, William A. 1987. Colorado flora: western slope. Boulder, CO: Colorado Associated University Press. 530 p. [7706]

296. Welch, Bruce L. 2005. Big sagebrush chemistry and water relations. In: Welch, Bruce L., ed. Big sagebrush: a sea fragmented into lakes, ponds, and puddles. Gen. Tech. Rep. RMRS-GTR-144. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 107-148. [55362]

297. Wells, B. W. 1942. Ecological problems of the southeastern United States coastal plain. The Botanical Review. 8(8): 533-561. [41623]

298. Welsh, Stanley L.; Atwood, N. Duane; Goodrich, Sherel; Higgins, Larry C., eds. 1987. A Utah flora. The Great Basin Naturalist Memoir No. 9. Provo, UT: Brigham Young University. 894 p. [2944]

299. Werner, Katherine J.; Zedler, Joy B. 2002. How sedge meadow soils, microtopography, and vegetation respond to sedimentation. Wetlands. 22(3): 451-466. [60630]

300. Wetzel, Paul R.; van der Valk, Arnold G. 1998. Effects of nutrient and soil moisture on competition between Carex stricta, Phalaris arundinacea, and Typha latifolia. Plant Ecology. 138(2): 179-190. [77298]

301. Wheeler, W. A.; Hill, D. D. 1957. Grassland seeds. Princeton, NJ: D. Van Nostrand Company. 628 p. [18902]

302. Whelan, Robert J. 1995. Survival of individual organisms. In: The ecology of fire. Cambridge, UK: Cambridge University Press: 57-134. [52505]

303. White, David J.; Haber, Erich; Keddy, Cathy. 1993. Invasive plants of natural habitats in Canada: An integrated review of wetland and upland species and legislation governing their control. Ottawa, ON: Canadian Wildlife Service. 121 p. [71462]

304. Whitt, Michael B.; Prince, Harold H.; Cox, Robert R., Jr. 1999. Avian use of purple loosestrife dominated habitat relative to other vegetation types in a Lake Huron wetland complex. The Wilson Bulletin. 111(11): 105-114. [37525]

305. Wilcox, Julia C.; Healy, Michael T.; Zedler, Michael T. 2007. Restoring native vegetation to an

urban wet meadow dominated by reed canarygrass (Phaliaris arundinacea L.) in Wisconsin. Natural Areas Journal. 27(4): 354-365. [70111]

306. Wilkins, F. S.; Hughes, H. D. 1932. Agronomic trials with reed canary grass. Journal of the American Society of Agronomy. 24(1): 18-28. [77614]

307. Willard, E. Earl; Wakimoto, Ronald H.; Ryan, Kevin C. 1995. Vegetation recovery in sedge meadow communities within the Red Bench Fire, Glacier National Park. In: Cerulean, Susan I.; Engstrom, R. Todd, eds. Fire in wetlands: a management perspective: Proceedings, 19th Tall Timbers fire ecology conference; 1993 November 3-6; Tallahassee, FL. No. 19. Tallahassee, FL: Tall Timbers Research Station: 102-110. [25778]

308. Wofford, B. Eugene. 1989. Guide to the vascular plants of the Blue Ridge. Athens, GA: The University of Georgia Press. 384 p. [12908]

309. Yahner, R. H.; Storm, G. L.; Melton, R. E.; Vecellio, G. M.; Cottam, D. F. 1991. Floral inventory and vegetative cover type mapping of Gettysburg National Military Park and Eisenhower National Historic Site. Tech. Rep. NPS/MAR/NRTR-91/050. Philadelphia, PA: U.S. Department of the Interior, National Park Service, Mid-Atlantic Region. 149 p. [17986]

310. Zolidis, Nancy Ritter. 1988. Restoration of a mined peatbog in Delafield Township, Waukesha County, Wisconsin: field and computer model studies of the hydrogeology and the growth of fen buckthorn (Rhamnus frangula). Madison, WI: University of Wisconsin--Madison. 208 p. Dissertation. [71378]

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