Rubus armeniacus, R. bifrons

SUMMARY

This Species Review summarizes the scientific information about fire effects and relevant ecology of *Rubus armeniacus* and *Rubus bifrons* in the United States and Canada that was available as of 2020. Both species are nonnative, very closely related, and share the common name "Himalayan blackberry". To avoid confusion, "Himalayan blackberry" refers to *R. armeniacus* in this Species Review, and *R. bifrons* is referred to by its scientific name.

Himalayan blackberry occurs in many areas of the United States and is invasive in the Pacific Northwest and California. It is considered the most invasive nonnative shrub on the West Coast, where it forms large thickets, displaces native plants, hinders wildlife movement, and causes economic losses. It is most common in mediterranean climates and prefers moist, well-drained soils. It is most invasive in low-elevation riparian, hardwood, and conifer communities. In contrast, *Rubus bifrons* is not considered highly invasive.

Both species reproduce primarily vegetatively via layering and sprouting from their rhizomes and root crown. They also reproduce from seed, which aids establishment on new sites, including burns. The seeds are primarily dispersed by animals. The seeds have a hard coat, are dormant upon dispersal, and are stored in the soil seed bank. Fire or animal ingestion helps break seed dormancy. These blackberries are primarily early-successional, fast-growing species that prefer open, disturbed sites such as streambanks and burns.

Himalayan blackberry foliage and litter can be flammable, but Himalayan blackberry may fail to burn on moist sites that lack substantial fine fuels. Himalayan blackberry and *R. bifrons* sprout after top-kill by fire, and they establish from seed after fire. Few studies assessed Himalayan blackberry's long-term response to fire as of 2020, and no fire studies were available for *R. bifrons*. Studies of a single and two consecutive prescribed fires suggest that in the short term, Himalayan blackberry abundance either remains similar on burned and unburned sites or increases after fire.

Himalayan blackberry displaces native riparian shrubs by overtopping and outcompeting them for space, light, and nutrients, especially water and nitrogen. It is very difficult to control because its root crown and large, often deeply buried rhizomes can sprout for many years after treatment, and animal seed dispersal provides a ready source of new infestations. Himalayan blackberry is best controlled using a combination of treatments over many years. These may include prescribed fire, mechanical treatments, grazing, and/or herbicides.

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This Species Review covers Himalayan blackberry and *R. bifrons;* however, as of 2020, little information was available in the scientific literature on *R. bifrons* despite an extensive search (see FEIS's list of source literature). Information about *R. bifrons* is provided in the second part of this review. Because the two species are very closely related, much of the regeneration, fire ecology, and control information pertaining to Himalayan blackberry likely applies to *R. bifrons*.

Literature cited in this Species Review include these reviews: [22,23,76,103,104,185,222]. Common names are used throughout this Species Review. See the Appendix for a complete list of plant and wildlife species mentioned in this Species Review.

- Rubus armeniacus
- Rubus bifrons

Rubus armeniacus

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Figure 1—Himalayan blackberry flowering at Deer Creek Center, Oregon. CalPhoto image © 2016 Keir Morse.

INTRODUCTION

SPECIES: Rubus armeniacus

FEIS Abbreviations

RUBARM

Common Names

Himalayan blackberry
Armenian blackberry
European blackberry
Himalaya berry

Taxonomy

The scientific name of Himalayan blackberry is *Rubus armeniacus* Focke (Rosaceae) [35,68,113,203]. The morphology and genetics of *R. armeniacus* and *R. bifrons* are very similar [74], and some systematists consider them the same species, with *Rubus bifrons* Vest ex. Tratt the accepted name [74,107]. This Species Review treats the two taxa as separate species. Both belong to the *R. fruiticosus* complex (subgenus *Rubus*) [45,104,150], an aggregate of blackberry species that are native to Eurasia [6,46,76] and primarily reproduce vegetatively [45]. Both blackberries share the common name "Himalayan blackberry". To avoid confusion, "Himalayan blackberry" refers to *R. armeniacus* in this Species Review, and *R. bifrons* is referred to by its scientific name.

Hybrids: Himalayan blackberry hybridizes with California blackberry [45,46], cutleaf blackberry [13,46,203], and Pennsylvania blackberry. Hybrid swarms of these blackberry species occur in the Pacific Northwest and California [45,46].

Figure 2—Himalayan blackberry (1, oval leaflets) growing with cutleaf blackberry (2, deeply divided leaflets). Forest Service, U.S. Department of Agriculture image by Janet Fryer.

Synonyms

Rubus discolor Weihe & Nees [62,81,128]
Rubus procerus auct. non P.J. Mull. ex Genev [131]

Rubus fruiticosus L. has been misapplied as a synonym of *R. armeniacus* Focke; in fact, it is the type species for the *R. fruiticosus* complex [76].

Life Form
Shrub

DISTRIBUTION AND OCCURRENCE

SPECIES: Rubus armeniacus

GENERAL DISTRIBUTION

Himalayan blackberry is native to the Near East of Asia [62,68]—in the region of Syria, Iraq, Jordan, and northern Saudi Arabia [68]—and to the Caucus Mountains of Eurasia (Turkey, Georgia, and Russia) [40,76]. There is no evidence that it is native to the Himalayan Mountains [76,104,131,185] or that it grows there now [104]. Himalayan blackberry is widely distributed in Europe [68], but its nativity there is uncertain [116]. While it is reported as native to western Europe (e.g. [22]), some systematists consider it nonnative in Europe [68]. Worldwide, Himalayan blackberry has been widely introduced for commercial and small-scale fruit production [76], and it has established in the wild on all continents except Antarctica [61]. Mexico is the largest commercial producer of Himalayan blackberry fruits [3].

In North America, Himalayan blackberry has escaped cultivation [25,35,81,100] and established in many wildlands of North America (fig. 3). In western North America, it occurs from southwestern British Columbia and western Montana south to northwestern Mexico [74,76,97,203,222]. In eastern North America, it occurs sporadically from southern Ontario, Delaware, and New Jersey south to southern Alabama. It is absent in the wild in much of the Great Plains [74,76,203,222]. In the United States, it has also established in Hawaii [203]. It is uncommon in the Northeast [81,188] and Southeast, but it occasionally escapes cultivation in Tennessee, Kentucky, and the Carolinas [81].

Himalayan blackberry is widely established and invasive in the Pacific Northwest and California [35,36,76]. Luther Burbank introduced a Himalayan blackberry cultivar, 'Himalayan giant', in Oregon in 1885 [104,116]. By 1945, Himalayan blackberry had spread along the West Coast [104], and Oregon State University Extension Service reports that it is now a "giant problem" in the region [35]. Himalayan blackberry is "occasional" in the wild in northwestern Mexico [97].

Populations of Himalayan blackberry become less frequent and dense east of the Southern Cascade Range and Sierra Nevada [91,172,193]. Himalayan blackberry is spreading into the Snake River Plain of Idaho [40], but it is rare in the Seven Devils Mountains of Idaho [20]. As of 2012, it was documented from one location in Montana (Missoula County) [128] and from one location on the Uncompahgre Plateau in eastern Colorado [211]. Himalayan blackberry occurs on disturbed sites in southwestern coastal Alaska [123]. Its date of introduction in the eastern United States in unclear, but by 1945 it had established in nursery and experimental sites along the East Coast and in Ohio [104].

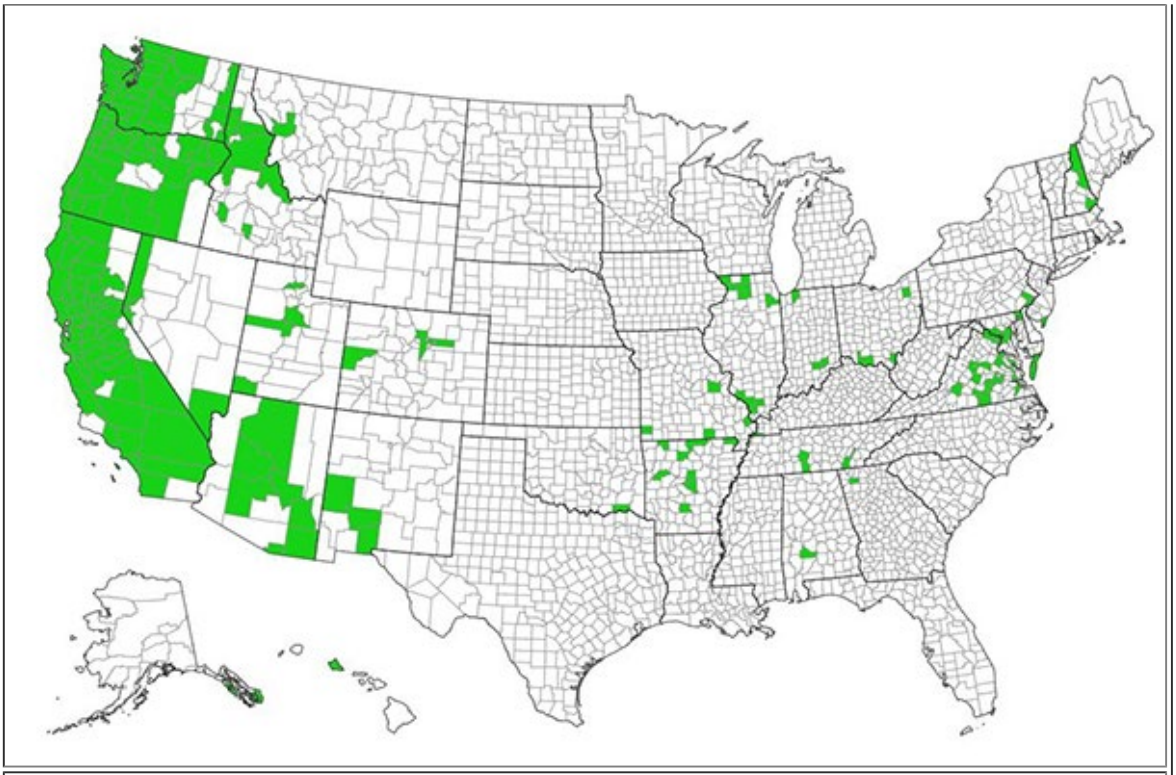

Figure 3—Distribution of Himalayan blackberry in the United States. Map courtesy of EDDMaps [67] [2021, March 9].

States and Provinces:
United States: AL, AK, AZ, AR, CA, CO, CN, DC, GA, ID, IL, KS, KY, LA, MD, MA, MS, MO, MT, NV, NJ, NM, NY, NC, OH, OK, OR, PA, RI, SC, TN, TX, UT, VA, WA
Canada: BC, ON [74,203]
Mexico: BCN [97]

SITE CHARACTERISTICS AND PLANT COMMUNITIES

Himalayan blackberry is most common in mediterranean climates. It may establish on a variety of sites, but it prefers moist, well-drained soils. It is invasive in low-elevation riparian, hardwood, and conifer communities of the Pacific Northwest and California.

Site Characteristics: Himalayan blackberry occurs in areas with mediterranean [40,173] and temperate [76,198] climates. In North America and globally, it is most invasive in regions with mediterranean climates (e.g., southern Oregon and California, western Chile, and southwestern Australia) [6,40,173]. In North America, Himalayan blackberry is most invasive in mediterranean areas [40,76,173,198] where annual rainfall averages >760 mm [104,185]. Prime locations for Himalayan blackberry establishment and spread include the interior valleys of western Oregon (i.e., the Willamette, Rogue, and Umpqua valleys [152]); and the Coast Ranges, Central Valley, and foothills of the Sierra Nevada in California [64,214]. Near the edges of its distribution, Himalayan blackberry is restricted to warm, wet sites [39] (e.g., Landsman Camp, Arizona [33]). It does not tolerate very cold temperatures [86,152] and does not occur in upper montane, alpine, boreal, and arctic regions [7,41].

Himalayan blackberry is a facultative wetland species [48], growing in both wetlands and uplands [35,37,40,141,168,185]. It is most common on warm, wet to moist [76,198], disturbed sites such as ditches and streambanks [62,185]. It is flood tolerant [22,61,115], withstanding periodic inundation by fresh or brackish water [61,99,103]. It can survive approximately 40 days of flooding, and it may initiate shoot growth after 2 weeks of submergence [76]. However, it cannot withstand months-long inundation. Himalayan blackberry may occur on the edges of perennial wetlands [84] but does not spread into them [185].

Himalayan blackberry grows at low elevations [86,152] and on all aspects, although best growth may occur on southerly aspects [40,76]. It occurs from 0 to 1,200 m—and occasionally up to 1,800 m—elevation across its range [74,104,185]. It is

reported from ≤1,200 m in the Seven Devils Mountains of Idaho [20] and from sea level to 654 m in British Columbia [76]. In the Willamette Valley and on the western slope of the Cascade Range, Oregon, Himalayan blackberry grows on slopes ranging from flat to steep (0%-90%, mean = 19%) [37,40]. On four riparian watersheds in western Oregon, it was not associated with topographic position (streamsides, midslope/floodplain terraces, or lower hillslopes) [173]. Surveys and analyses of plant species distributions in Yosemite National Park found it was not associated with aspect, geology, or plant species groupings [198].

Himalayan blackberry prefers loamy, nutrient-rich soils [76], but it tolerates a wide range of soil textures [22,37,40,76,194], fertility levels, and pH ranges [22,37,40,76]. It grows in both acidic [37,40,76,104,185] and alkaline soils [76,104,185]. It favors moist, coarse-textured soils but does not require them. In the Willamette Valley and on the western slope of the Cascade Range in Oregon, Himalayan blackberry is most common in sandy soil, but it also grows in gravelly, loamy, and clayey soils [37,40]. Soils supporting Himalayan blackberry are generally high in organic matter; however, Himalayan blackberry colonizes bare gravel and fill [37,40].

Himalayan blackberry occurs in soils derived from a wide variety of parent materials, including granite, limestone, and basalt [215]. It also grows in alluvium [118,190,194]. In foothills of El Dorado County, California, Himalayan blackberry grows in soils derived from gabbrodiorite [215].

Plant Communities: Himalayan blackberry is considered invasive in low-elevation riparian, hardwood, and conifer communities of the West Coast [1,7,22,64,73], but it is not invasive in upper montane forests [7]. Specific information on Himalayan blackberry occurrence in communities of western North America follows.

- **Pacific Northwest**
- **Blue Mountains and Idaho**
- **California (excluding deserts)**
- **Desert Regions**

Pacific Northwest: Himalayan blackberry grows in grassland and riparian shrubland, hardwood, and conifer communities in the Pacific Northwest. In southwestern British Columbia, it occurs in riparian hardwood and conifer communities. Himalayan blackberry occurs in the Coastal Douglas-Fir, Coastal Western Hemlock, and Interior Western Redcedar-Western Hemlock Biogeoclimatic Zones; it is most widespread in the Coastal Western Hemlock Zone [76]. It is a dominant understory shrub in black cottonwood communities on alluvial floodplains [118] and in riparian red alder-bigleaf maple/Nootka rose-Himalayan blackberry communities [57].

In Washington, Himalayan blackberry occurs in shrubland and conifer communities. On the Dungeness and Hoh river watersheds on the Olympic Peninsula, it grows in patches within riparian shrub communities and in riparian western hemlock-Douglas-fir forests and clearcuts [55]. On the north wall of the Columbia River Gorge, it grows in ravines within coastal Douglas-fir and western redcedar forests [219].

In Oregon, Himalayan blackberry occurs in riparian areas [84], seasonally flooded wet grasslands and marsh edges [109,175], native fescue and other prairies [217], oak woodlands [84], and coniferous foothill woodlands and forests [85]. Himalayan blackberry is often associated with other nonnative invasive species in these communities [32,48,133,175,194]. On Myrtle Island, Himalayan blackberry forms "nearly impenetrable thickets" in the understory of alluvial red alder-Oregon ash/Himalayan blackberry/reed canarygrass floodplain communities. Pacific poison-oak is a frequent associate [194]. In northwestern Oregon, Himalayan blackberry averaged 30% frequency and 2% cover in Columbian sedge associations on low-elevation floodplains and in foothill fens that are now largely dominated by nonnative reed canarygrass [133]. In one survey, Himalayan blackberry occurred in a seasonally flooded reed canarygrass wetland in the Willamette Valley that was totally composed of nonnative species [175].

In conifer communities, Himalayan blackberry grows in low-elevation ponderosa pine [1] and ponderosa pine-coastal Douglas-fir woodlands and forests of the Southern Cascade Range [64,91,108,172]. On the McDonald-Dunn Research Forest near Corvallis, it occurs on rounded ridgetops in grand fir/California hazelnut/white insideout flower forests [85].

Himalayan blackberry is especially common in the Willamette Valley of Oregon, where it occurs in wet grassland [175], riparian shrub, [48,73], riparian woodland (e.g., black cottonwood [48,72] and sandbar willow [122]), and Oregon white oak [32,160,175] communities. California blackberry-Himalayan blackberry/reed canarygrass and black cottonwood/California blackberry-common snowberry-Himalayan blackberry communities occur on elevated floodplains along the Willamette

River [48]. Himalayan blackberry commonly forms dense understories in white oak communities [32,73]. Pacific poison-oak is a frequent to dominant member of these communities [32]. Frequency and cover of Himalayan blackberry in white oak communities in the Willamette Valley are provided in Buechling et. al (2008) [32].

Blue Mountains and Idaho: East of the Cascade Range, Himalayan blackberry grows on sites with relatively moist soils. In the Blue Mountains of Washington and Oregon, it occurs in silver sagebrush/tufted hairgrass associations, in warm soils with "moderate" soil moisture levels [160]. In west-central Idaho, Himalayan blackberry colonies are reported as "occasional" in white alder/Lewis' mock orange communities along the Snake River and its tributaries [142].

California (excluding deserts)**:** In California, Himalayan blackberry occurs in seasonal marshes [190], riparian hardwood woodlands and forests [77,127,169,190] (fig. 4), and low-elevation conifer woodlands and forests [64,91,172,183]. In a survey in Castle Crag State Park in northwestern California, Himalayan blackberry dominated the shrub layers of white alder-coast Douglas-fir-incense-cedar riparian forests [190]. In the Central Valley, Himalayan blackberry occurs in white alder [77,127,169,190], Fremont cottonwood, and valley oak riparian woodlands [77,127,134,169,192,205]. It also grows in riparian northern California black walnut/American black elderberry associations [205]. Nearly all riparian forests in the Sacramento Valley contain Himalayan blackberry, including remnant hardwood forests with relatively high cover of native vegetation [134].

Figure 4—A riparian California black oak-oracle oak-ponderosa pine/Himalayan blackberry woodland in Tuolumne County, California. Forest Service, U.S. Department of Agriculture image by Janet Fryer.

In conifer communities, Himalayan blackberry grows in low-elevation ponderosa pine [1] and ponderosa pine-coastal Douglas-fir woodlands and forests of the Southern Cascade Range, Klamath Mountains, and Sierra Nevada [64,91,172], and in redwood forests of the Coast Ranges [21,24,171,183].

Desert Regions: Himalayan blackberry is restricted to riparian zones or sites with perennial ground water, such as springs and seeps, in desert locations. A ruderal Himalayan blackberry-rattlebox-common fig shrubland alliance occurs near mountain springs in Death Valley, California, at 728 to 1,401 m elevation. All dominant species in this alliance are nonnative [145]. At the abandoned mining site of Landsman Camp, Arizona, Himalayan blackberry grows with peach, Palmer's century plant, and goldenflower century plant [33]. Landsman Camp supports an Arizona walnut-Arizona sycamore community within an Emory oak-gray oak-alligator juniper ecosystem [33]. This suggests s higher ground water level than that of the

surrounding scrub oak-juniper community, where Himalayan blackberry does not occur.

See table A3 for a representative list of plant community classifications in which Himalayan blackberry is invasive.

BOTANICAL AND ECOLOGICAL CHARACTERISTICS

SPECIES: Rubus armeniacus

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., [35,81,100,128]).

Himalayan blackberry is a trailing shrub [62,74,113,185] or subshrub [113,203]. Vegetative stems (primocanes) arch, then droop and trail along the ground. They are generally from 1 to 7 m long [62,74,81,104], averaging about 3 m long [104]. Flowering stems (floricanes) branch out from primocanes [74]. In western Oregon, primocane stems ranged from 0.5 to 1.4 m long (mean = 0.9 m), and stands ranged from 0.8 to 3.4 m tall (mean = 1.5 m) [40]. The stems are armed with large, recurved to straight prickles [62,74,81,193]. The thick, arching stems and large prickles help distinguish Himalayan blackberry from other blackberry species of North America [177].

Figure 5—Himalayan blackberry fruits. Image by Eric Coombs, Oregon Department of Agriculture, Bugwood.org.

The leaves of Himalayan blackberry are deciduous to evergreen [62,74]. Himalayan blackberry is sometimes described as "semievergreen" because its leaves stay green well into fall [22], and some leaves are retained through winter. The compound leaves have mostly three leaflets on primocanes and mostly five leaflets on floricanes [62]. They are armed with short prickles [62,74,81,193].

Himalayan blackberry's inflorescence is a panicle with perfect flowers [74,76,220]. The fruit is a fleshy drupe [199] consisting of an aggregate of 15 to 40 tiny, one-seeded drupelets or individual fruits (fig. 5) [62,76] that adhere to the fruit-bearing part (torus) [76,199]. Each drupelet contains a single, hard-coated nutlet [220].

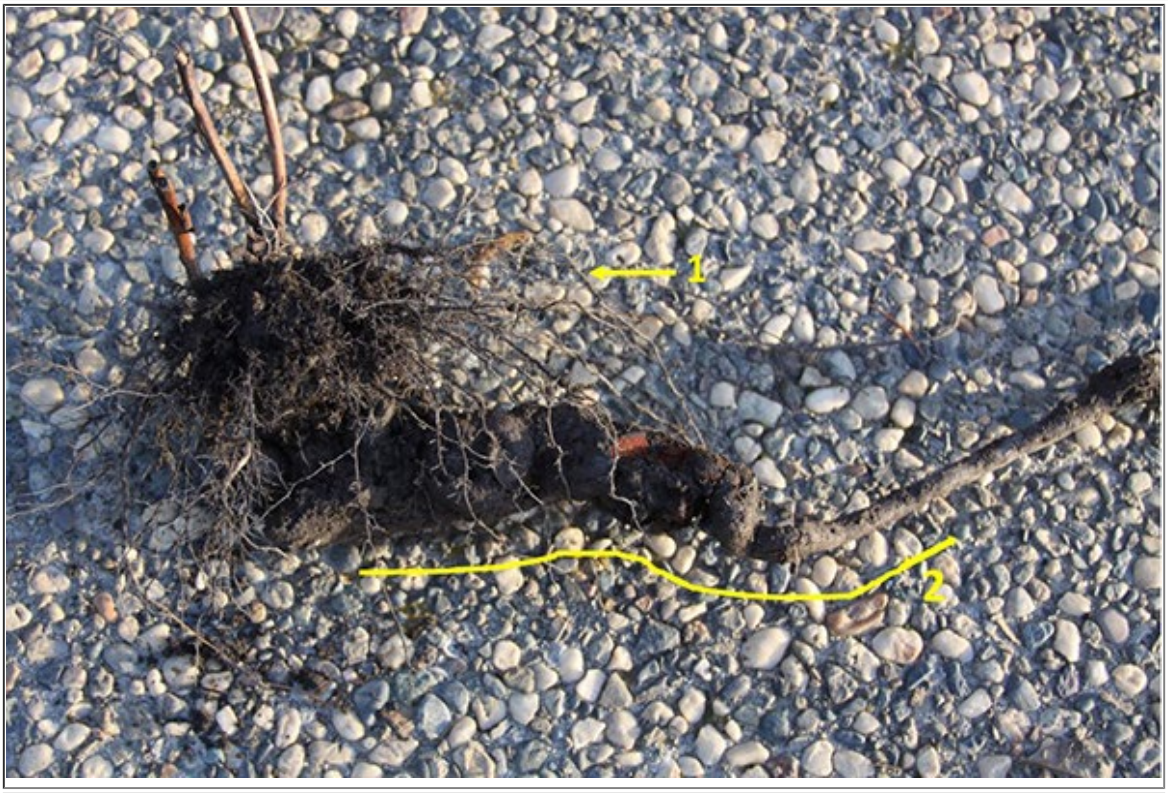

Figure 6—Roots (1) and rhizome (2) of Himalayan blackberry. Forest Service image by Janet Fryer.

Lateral roots and rhizomes grow out from Himalayan blackberry root crowns [185] (fig. 6). The root-rhizome system has been described as large [39]. A mean density of 10.4 root crowns/m² (range: 1.5-21.5 root crowns/m²) was documented in western Oregon [18]. Most Himalayan blackberry root-rhizome systems grow down to about 0.5 m deep, although some may grow down to about 2 m deep [199]. On some plants, the roots and rhizomes extend 10 m long and 0.9 m deep [104,185]. While Himalayan blackberry stems are short-lived (see Seasonal Development), the roots and rhizomes are perennial [61]. Himalayan blackberry is sometimes misidentified as biennial because of the short lifespan of its canes [76].

Stand Structure: Himalayan blackberry stands may form large mounds [104] and/or dense thickets of trailing stems that envelop banks or other areas [32,73,76,77,104,127,169]. Thickets may attain a density as high as 525 canes/m² [104].

Raunkiaer Life Form:
Phanerophyte
Geophyte [163]

SEASONAL DEVELOPMENT

Himalayan blackberry primocanes elongate in spring and complete growth by fall [199]. Primocanes die in late fall or winter [58,199,208] of their second [61,104] or third [104] year. Floricanes grow out from second- and third-year primocanes [61]. They remain short but grow small, lateral branchlets that produce flowers and fruits [58,185,199,208].

The flowering and fruiting periods of Himalayan blackberry are staggered [154,220], with flowers emerging intermittently

from spring to summer and fruits ripening intermittently from summer to fall [74,220] (table 1). This fruiting period is later than that of native blackberry species [15,104,185]. Seeds germinate in spring [76,104,185], although few germinate their first year after dispersal [185].

Table 1—Phenology of Himalayan blackberry by area.

Area	Event
United States	
Northeast	flowers June-August [81]
Pacific Northwest	flowers June-August; fruits ripen August-September [26]
Rocky Mountains	flowers March-April; fruits ripen April-May [26]
California	flowers April-September [35,199]
Washington	leaves emerge late April [15]; flowers June-August; fruits ripen August-September [15,222]
Canada	
British Columbia	flowers May-August; fruits ripen August-September [76]

REGENERATION PROCESSES

Reproductive Mechanisms: Blackberries, including Himalayan blackberry, have one of the most versatile systems for reproduction, colonization, and maintenance among woody plants [222]. Himalayan blackberry primarily reproduces vegetatively by sprouting and layering [45,154,222], which are important for population maintenance and spread. It also reproduces from seed, both sexually via pollination and asexually by apomixis [13,45,46,63,120,154]. Reproduction from seed and subsequent seed dispersal are important for its spread onto new sites [45,154]. Himalayan blackberry hybrids also reproduce by sprouting and layering [45], as well as from seed [45,46].

Vegetative Regeneration: Himalayan blackberry sprouts from its rhizomes [76,124,167,199] and root crown [76,104,154,167,199] (figs. 6 and 7). Additionally, it layers at the ends of trailing primocane stems [76,104,124] when they contact soil [37,39,62,76,104,185]. Himalayan blackberry's ability to layer facilitates rapid spread after colonization [39]. Survival of daughter plants from layering Himalayan blackberry plants is usually higher than that of seedlings [8].

Waterways, flood waters, and landslides disperse Himalayan blackberry stems [122,155], which may sprout or layer after deposition [122]. In Grand Canyon National Park, Himalayan blackberry was cultivated at Indian Garden but might have spread to Pipe Creek, a tributary of the Colorado River [25], via water transporting stems. In Oregon's Coast Ranges, Himalayan blackberry apparently established in a debris-flow deposit that contained transported rhizomes [155].

Pollination and Breeding System: Himalayan blackberry is dioecious [222]. Most Himalayan blackberry seeds develop apomictically, so its genetic diversity is low. Occasional sexual reproduction increases genetic diversity in Himalayan blackberry populations [120]. Himalayan blackberry is considered a facultative pseudogamous apomict because it produces seeds both sexually (via pollination) asexually via apomixis (specifically agamospory, or formation of seeds without pollination and sexual fertilization) [13,45,46,63,120,154,222]. Apomixis is characteristic of blackberries native to Eurasia;

blackberries native to North America do not reproduce apomictically [46].

Himalayan blackberry is both self- and cross-pollinated [46,120,150]. Cross-pollination results in larger fruits and higher seed sets [120]. Native bees and nonnative honey bees are the primary pollinators [75,76,180]. In a seasonal wetland in Oregon, about 70% of Himalayan blackberry pollinating visitors were honey bees, and about 20% were bumble bees and ground-nesting bees. Other pollinating visitors included leafcutting bees, sweat bees, soldier beetles, syrphid flies, snipe flies, and skipper butterflies [180].

Seed Production and Predation: Himalayan blackberry can produce large seed crops [40]; up to 720 fruits/stem [137]. In thickets, Himalayan blackberry may produce from 7,000 to 13,000 seeds/m^2. Good fruit and seed crops occur nearly every year [104,185], although plants generally do not produce fruits when growing in dense shade [104,185]. Seedlings require 3 years to produce flowering canes [124]. Coarse, well-drained soils may impede Himalayan blackberry flower and seed production unless they remain moist. In Oregon, floricane length was negatively associated with soils of >20% gravel content [40].

Many animal species eat Himalayan blackberry fruits (see Importance to Wildlife and Livestock) and consequently, disperse the seeds. Information on predation of soil-stored seed was not found in the literature.

Seed Dispersal: Frugivorous animals and water disperse Himalayan blackberry seeds [17,22,31,104,122,140,185,220,222]. Animals are the primary dispersers [17,220]; the seeds are readily dispersed to new areas by mammals and birds [17,31,185]. Himalayan blackberry establishment on the San Juan Islands, Washington, is attributed to frugivorous birds [17]. Pacific banana slugs also consume Himalayan blackberry fruits and disperse their seeds [80]. Himalayan blackberry seeds can spread long distances via streams and rivers [103]. A 3-year study in western Washington found Himalayan blackberry seeds were present in low numbers (0.02 seed/kl of water) in water from the Columbia River and in irrigation water from drainages in the Yakima Valley [114].

Humans indirectly promote Himalayan blackberry seed dispersal via cultivation. It is probable that animals will eat the fruit of cultivated plants and consequently, disperse Himalayan blackberry seeds to new locations.

Seed Banking: Himalayan blackberry has a persistent, soil-stored seed bank [49,61,222]. On 15 sites in Lewis and Clark National Historical Park, Oregon, frequency of Himalayan blackberry seeds in soil core samples averaged 0.4%. Soil cores were 8.5 cm in diameter and 30 cm deep (n = 100 ml subsamples of the soil cores) [117]. Information on the long-term viability of Himalayan blackberry seeds was lacking as of 2020. Anecdotal observations suggest that seeds remain viable for a least "several years" [104]. Gaire (2015) suggested that seeds are viable in soil for at least 1 or 2 years [76]}

Germination: Blackberries are generally slow to germinate due to mechanical dormancy imposed by the hard seed coat and endocarp [56,185,222], chemical germination inhibitors in the seed coat and endocarp, and a dormant embryo [222]. Few Himalayan blackberry seeds germinate in their first year after dispersal [103,185]; in the field, seeds may take 2 to 3 years to fully germinate. Seed dormancy is broken by a combination of factors, including freeze-thaw cycles [154,222]; diurnal and annual changes in temperature (stratification) [131,222]; cycles of wetting and drying of the seed coat [222]; and scarification of the seed coat by fire [148], passage through the digestive system of animals (i.e., acid treatment) [31,76,104,154,220,222], or damage inflicted by fungi and/or insects [222]. Seed passed through the digestive tracts of various species of birds in New Zealand had up to 17% higher germination than undigested seeds [148]. However, an Australian study found seedling emergence of Himalayan blackberry was similar in digested and undigested seeds, averaging about 35% from red fox droppings, 34% from emu droppings, and 32% from undigested seeds [31].

Seedling Establishment and Plant Growth: Himalayan blackberry seedlings favor open habitats for establishment [40,103,104]. In Australia, Himalayan blackberry seedlings required ≥45% sunlight to survive [185]. Seedlings are more likely to establish in open stands than beneath Himalayan blackberry canopies or in crowded stands [104], where their growth is surpassed by rapidly growing, vegetative daughter plants [103]. A model developed by Lambrecht-McDowell and Radosevich (2005) suggests that as populations increase in density, Himalayan blackberry spread may increasingly convert to sexual reproduction and consequent seed dispersal and seedling establishment onto new sites [124].

Growth of Himalayan blackberry is rapid on moist, open sites [39,40]. Plants in shade have slower growth rates than those in the open [37,40]. When spreading, young plants first produce a few canes; then, groups of canes form mounds and finally, thickets [185]. Canes may grow as long as 7 m in a single season [104]. Propagation of a single Himalayan blackberry stem

cutting produced a thicket 5 m in diameter in 2 years in Australia, and well-established Himalayan blackberry plants developed nearly 10-m-long root-rhizome systems that extended up to 90 cm deep [8]. Primocanes gain little new length or height growth in their second year, but they develop lateral branches (floricanes) that produce flowers and fruits [222]. Stem lengths may increase as Himalayan blackberry stands become denser and light more limited. Near Corvallis, Oregon, primocane stems were longer in high- than in low-density populations (345.1 and 336.7 cm, respectively). Furthermore, turnover (mortality) of seedling canes was greater in high- than in low-density populations (72% and 58%, respectively) [124].

Himalayan blackberry's extensive root-rhizome system helps it access and store water [39], promoting rapid growth. Himalayan blackberry grows faster in moist than in dry soils, and its growth rate is often faster than that of associated woody species [8,76]. After 100 days in a greenhouse in Oregon, Himalayan blackberry cuttings averaged greater root biomass than those of four native shrubs (California blackberry, Nootka rose, salmonberry, and thimbleberry). Furthermore, Himalayan blackberry canes had higher water content than all but California blackberry [39,40]. The root-rhizome system of Himalayan blackberry acquired more water in winter, and during a simulated "drought" period of low watering in summer, the roots absorbed more water more quickly than the native shrubs [40]. Additionally, Himalayan blackberry had the greatest ability to regulate its leaf area in both wet and dry soil. In wet soil, it grew large leaves and had faster shoot and root growth rates than the native shrub species. In dry soil, it grew small leaves while still maintaining high xylem tissue**:**leaf area ratios, so water conductivity remained robust despite the induced "drought" [39,40]. Plasticity in allocation of leaf area, and of carbon acquisition according to water availability, likely allows Himalayan blackberry to colonize excessively well-drained sites such as gravel pits, fill sites, and steep slopes [40]. In a greenhouse study in California, Himalayan blackberry seedlings had the second-highest relative growth rate and specific leaf area of 28 nonnative woody species [88,89].

SUCCESSIONAL STATUS

Himalayan blackberry occurs in early- to late-successional communities [40,95], but it is most common in early succession [40,103]. It is often found on disturbed sites [95,104,155], including burned areas [91,122,191,222] and bare gravel and fill [37,40,155]. It is favored in riparian areas where flood disturbance is chronic and the canopy is open to partially closed [95]; in "waste" places and ditches; and along roadsides, fencerows, and rights-of-way [62,185]. It also grows in pastures [22,185], old fields [51], and disturbed wildlands [95] such as forest plantations [22,185]. In black cottonwood woodlands along the Willamette River, Himalayan blackberry frequency averaged 89% in early-seral stands (12-16 years old), and it occurred at "low frequency" in late-seral stands (45 to >60 years old). It was not found in stand initiation (1-3 years old), stem exclusion (4-7 years old), or midseral (22-50 years old) stages [72].

Himalayan blackberry is described as shade intolerant [15,95,222]. It grows in light to moderate shade [32,40,44,95,222] but does not tolerate deep shade [14,21,22]. It is most common [15,95,222] and likely to spread on sites with open canopies. In the Willamette Valley, Himalayan blackberry forms dense populations along forest edges and in the understories of open woodlands [32]. It does not establish well beneath its own canopy or under closed overstory canopies [8,185].

Although Himalayan blackberry is most common under open canopies, it may persist under partially closed canopies [40]. In southern Oregon and northern California, it was present in both <7-year-old plantations and adjacent second-growth, 60- to 90-year-old mixed-conifer forests [108]. Himalayan blackberry does not persist under closed canopies ([37,40], abstract by [147]). In redwood forests of the Santa Cruz Mountains, California, density of Himalayan blackberry decreased as canopy gap size and light availability decreased. In the Willamette Valley and the western slope of the Cascade Range in Oregon, stand height of Himalayan blackberry was positively associated with open canopies ($R^2 = 0.44$, $n = 41$ sites). Canopy cover on sites with Himalayan blackberry averaged 30% (ranging from 0%-88%) [37,40]. Himalayan blackberry was less successful at establishing in small canopy gaps than shrubs with less trailing, more upright forms, such as native California blackberry and Nootka rose [39]. Himalayan blackberry may be replaced by shade-tolerant species in woodland and forest succession [21,76]. However, using Forest Inventory and Analysis (FIA) data, Gray (2005) found that Himalayan blackberry cover was positively correlated with tree canopy cover in western hemlock forests of western Oregon ($R^2 = 0.16$, $n = 252$), but its frequency decreased with increasing tree basal area [83]. Also using FIA data, McIntosh et al. (2009) found "few relationships" between Himalayan blackberry and overstory cover in coastal Douglas-fir forests of western Oregon [138].

Himalayan blackberry may be important in old field succession. In Washington and Oregon, it commonly grows in old fields along with pasture grasses, tansy ragwort, and Scotch broom [51].

FIRE ECOLOGY AND MANAGEMENT

SPECIES: Rubus armeniacus

FIRE EFFECTS

Immediate Fire Effects on Plant: Fire top-kills Himalayan blackberry [104,122]. Himalayan blackberry stems on moist sites may fail to burn, or be only lightly scorched and survive [122].

Postfire Regeneration Strategy:

Tall shrub with a sprouting root crown
Rhizomatous shrub, rhizome in soil
Geophyte, growing points deep in soil
Initial off-site colonizer (off site, initial community)
Secondary colonizer (on- or off-site seed sources) [189]

Fire Adaptations: Himalayan blackberry has morphological and regeneration characteristics that enable it to survive and regenerate after fire. Soil insulates its root crown and rhizomes, protecting them from injury from fire (fig. 7). Himalayan blackberry has a soil-stored seed bank, and fire may break dormancy of its seed, so postfire seedling establishment is possible. Seed dispersal by animals allows for establishment onto new sites, including burns (see Regeneration Processes). Its growth is favored on open sites such as burns [122].

Plant Response to Fire: Himalayan blackberry sprouts [1,22,148] (fig. 7) and establishes from seed after top-kill by fire [122,148,157,158]. Both seedlings and mature plants may sprout after fire [122]: seedlings sprout from their root crown and more mature plants from both their root crown and rhizomes (see Vegetative Regeneration). Himalayan blackberry density may increase after fire in open, postfire environments [59,122,222]. Fire can increase germination rates of Himalayan blackberry by cracking the hard seed coat [148]. Lake (2007) observed that in Oregon, Himalayan blackberry tends to increase "reproductive effort" (i.e., seed production and seedling establishment) after fire or other disturbances [122].

Figure 7—Himalayan blackberry root crown sprout (a) and rhizome (b) in postfire year 2. A sprout from this rhizome was about 0.6 m away. The yellow arrow shows the soil line, which is 5 cm above the root crown. Forest Service image by Janet Fryer.

Studies on the effects of fire on Himalayan blackberry were few as of 2020 [16,91,149,157], and all but one [91] was conducted in the Willamette Valley. These studies investigated the short-term effects of single or multiple consecutive prescribed fires on Himalayan blackberry. Studies on the long-term effects of fire on Himalayan blackberry were lacking as of 2020. The few studies conducted suggest that in the short term, fire alone has little effect on or is likely to increase Himalayan blackberry abundance.

After late summer prescribed fire or mowing treatments in a remnant wet meadow in the Willamette Valley, Himalayan blackberry cover in postfire year 1 was similar on control and treated plots. Himalayan blackberry sprouted on both burned and mowed sites. Historically, native fescues and sedges dominated the meadow, but nonnative tall fescue has become dominant, with Himalayan blackberry codominating in relatively dry patches of the meadow [16]. Similarly, in a remnant tufted hairgrass prairie in the Willamette Valley, frequency of Himalayan blackberry was similar before and 7 years after

either late summer-early fall prescribed fire or mowing [149].

In shrubland/seasonal wetland prairie communities in the Willamette Valley, both a single fall burn and two consecutive fall burns generally increased the density of Himalayan blackberry and cutleaf blackberry in the short term. Blackberries were present on all transects where they occurred before fire; the authors did not distinguish between the two blackberry species. Compared to prefire density, mean blackberry density in postfire year 2 increased on three of four once-burned transects, and on three of four twice-burned transects (table 2). The authors speculated that in the long term, repeated burning may gradually reduce the density and slow the spread of the blackberries and other woody species that were becoming invasive in the wetland prairie [157,158].

Table 2—Combined density of Himalayan blackberry[a] and cutleaf blackberry[a] stems on nine 3 × 30-m transects, before and after fall prescribed fire in the Willamette Valley. Once-burned sites were burned in fall 1988; twice-burned sites were burned in fall 1988 and fall 1989. Prefire and postfire data were collected in August and September of 1988 and 1990, respectively. Data are means; statistical differences were not determined. Modified from [157].

Site and plant community	Blackberry[a] density (stems/ha)					
	Unburned control		Once burned		Twice burned	
Year	1988	1990	1988 (prefire)	1990	1988 (prefire)	1990
Rose Prairie: Nootka rose/sweet vernalgrass[a]	22	22	0	0	89	67
Rose Prairie: Nootka rose/dwarf bilberry	4	0	0	30	15	37
Fisher Butte: Nootka rose/sweet vernalgrass	0	0	2	11	0	4
Fisher Butte: Nootka rose/dwarf bilberry	7	7	6	33	2	9

[a]Nonnative species.

A study in northern California shows a similar trend, with little change in Himalayan blackberry abundance after single prescribed fires in Sierra mixed-conifer forests on the Challenge Experimental Forest and in Shasta County, California. In posttreatment years 10 or 11, neither mastication alone nor mastication followed by prescribed fire had reduced Himalayan blackberry basal area compared to untreated control sites [91].

FUELS AND FIRE REGIMES

- **Fuels**
- **Fire Regimes**

Fuels: The foliage of Himalayan blackberry has been described as "explosively flammable" [22,36]. Some Himalayan blackberry thickets have large amounts of litter and standing dead canes, which contributes to fire hazard [40,103,104,185] and horizontal fuel continuity (fig. 8). Additionally, Himalayan blackberry may suspend tree canopy litter above the ground (fig. 9). Where dense, Himalayan blackberry provides a continuous horizontal fuelbed (fig. 4), and where soil is not saturated, the foliage may contribute to high fire intensities (personal observation by Lake [122]). Fires may be particularly intense where Himalayan blackberry stands have an understory of abundant fire fuels. During a fall prescribed fire on the Jan T. Lowrey Cache Creek Nature Preserve near Woodland, California, patches of Himalayan blackberry with a ground layer of native and nonnative graminoids fueled the highest temperatures recorded during the fire. Temperatures across the burn site ranged from 42.5 °C to 454 °C [93].

However, Himalayan blackberry stands do not burn well on some sites [122,185]. Wetlands or some riparian areas with Himalayan blackberry may be too moist to burn [122]. On sites where Himalayan blackberry's stems and foliage are sparse and a substantial layer of fine herbaceous fuels is lacking, fires may be of low severity or patchy, or may fail to carry [185].

During a fall prescribed fire on the Klamath River (Klamath National Forest, California), flame lengths generally ranged from 0.5 to 2 m in sandbar willow/Himalayan blackberry/sedge riparian communities. Although the fire flared as high as 8 m where grasses and yellow starthistle grew beneath Himalayan blackberry, Himalayan blackberry failed to carry fire in moist, interior portions of the riparian zone [122]. Lake (2007) reported that in western Oregon, "Drip torch ignition where blackberries could be penetrated was (of) low intensity and very slow rate of spread, often extinguishing in shadier/damper areas. Approximately 5% of the area experienced high severity, 30% moderate, 40% low and 25% unburned as determined by post-fire visual estimates and photographs. Of the total sampled area (2,400 meters²) 75% was influenced by fire". Density of Himalayan blackberry stems was reduced by 28.9% compared to prefire density [122].

Himalayan blackberry leaves may provide a smaller fuel load than the leaves of native congeners. Specific leaf area (SLA) is used as a measure of leaf flammability, with low SLA associated with reduced flammability [144]. On the McDonald-Dunn Research Forest, mean SLA was significantly lower for Himalayan blackberry (126.65 cm²/g) than for native California blackberry and whitebark raspberry (156.21 and 221.02 cm²/g, respectively) [136,137]. However, Himalayan blackberry leaves are generally larger in low-light than in high-light conditions [39,40], so its SLA will likely be higher beneath tree canopies than on open sites.

Figure 8—Himalayan blackberry understory in a Fremont cottonwood-shining willow riparian community. Dead and live Himalayan blackberry canes have captured much of the tree litter. The Himalayan blackberry shrub layer is about 2 m tall, arching into low tree branches. Forest Service image by Janet Fryer.

Figure 9—A different view of the community shown in figure 8. Himalayan blackberry canes are continuous, suspending dead tree branches above the ground. Annual grasses are growing in patches where Himalayan blackberry stems have not yet layered. Forest Service image by Janet Fryer.

Figure 10—A fall prescribed fire in a Himalayan blackberry/yellow starthistle-annual grass old field in Tuolumne County, California. The fire flared where yellow starthistle was dense. Himalayan blackberry canes without a substantial herbaceous layer below were scorched but did not ignite. Forest Service image by Janet Fryer.

Himalayan blackberry produces prodigious litter, although the rate at which its litter decays may be similar to decay rates of associated species. Himalayan blackberry stem and leaf fragments (<2 mm) were common in soil samples taken in the Willamette Valley and the western slope of the Cascade Range. Soils beneath Himalayan blackberry were high in organic detritus, likely from decayed Himalayan blackberry litter [37,40]. In Victoria, British Columbia, Himalayan blackberry leaf litter on a stream bank decayed at a rate similar to that of red alder and Sitka willow [115].

Fire Regimes: The plant communities in which Himalayan blackberry occurs experience a wide variety of fire regimes. In the West, oak and ponderosa pine communities historically had a fire regime of frequent, low-severity surface fires [1,201]. Riparian communities had more variable fire intervals: fires intervals were often short and fires of low severity [202], but fires were sometimes infrequent and of mixed severity [156] or stand replacing [125].

For additional fire regime information, see FEIS publications on historical fire regimes in the following plant communities in which Himalayan blackberry is invasive:

Pacific Northwest:

- Pacific Northwest riparian communities
- Red alder landside
- Pacific Northwest wooded volcanic flowage communities
- Montane riparian communities in California and southwestern Oregon
- Oregon white oak communities
- Western hemlock wet-mesic communities
- Western hemlock mesic-dry communities
- Pacific Northwest coastal forests

Blue Mountains:

- Blue Mountains conifer communities

California:

- Montane riparian communities in California and southwestern Oregon
- Woody riparian communities of the Central Valley, California
- California oak woodland communities
- California coastal and valley hardwood communities
- Sierra Nevada hardwood communities
- California montane mixed-conifer communities
- Redwood communities

It is unclear how fuel loads and fire regimes of invaded plant communities may be affected by Himalayan blackberry. Quantitative comparisons of fuel loads in invaded versus uninvaded communities were lacking as of 2020. Fuels are difficult to measure in Himalayan blackberry thickets due to inaccessibility [91]. However, Himalayan blackberry forms dense thickets [76,77,103,127,169], and dense Himalayan blackberry populations can potentially alter fuel loads and fire behavior on invaded sites. Himalayan blackberry thickets may displace native plant species, including native blackberries [36] (see Impacts), and change the physical structure of invaded communities.

FIRE MANAGEMENT CONSIDERATIONS

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 propagules into burned areas. 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: [9,27,82,204].

Because Himalayan blackberry sprouts after fire, fire alone does not control it [23,59,60]. Himalayan blackberry density tends to be unchanged or higher after fire than before [16,149,157] (see Plant Response to Fire) without postfire treatments to control sprouts ([59,60], personal communications cited in [122]). Mechanical fuels reduction treatments also tend to increase Himalayan blackberry density (personal communications cited in [122]). When prefire mechanical control treatments are used, cut stems may root, sprout, and reestablish, so pile burning the stems is recommended [104].

Because fire top-kills Himalayan blackberry [60,104,185], fire can be used in conjunction with other methods to increase overall efficacy of control treatments [1,22,61,185]. Agee (1986) stated that while "fire can temporarily control blackberry spread, it is not very useful in eliminating it from the site. Spot application of herbicide to remove blackberry selectively, or mowing as an alternative to burning, might be useful adjuncts to the use of fire" [1]. Repeated burning may gradually reduce the density and slow the spread of Himalayan blackberry [104,157,158,185].

Long-term control of Himalayan blackberry after fire may be obtained by:

(1) herbicide treatment of sprouted canes, in the fall following burning,
(2) subsequent burning or cutting to exhaust the soil seed bank and carbohydrate reserves in roots and rhizomes, and/or
(3) revegetation with fast-growing or shade-tolerant native species [104,185].

Burning Himalayan blackberry may be most effective on slopes, especially slopes with a grass (fine fuels) component to help carry the fire. Fall burning may not be possible in many years due to risk of high-severity fires. Burning in other seasons may require augmenting fuels. Scoll (1994) wrote that "in order to avoid burning during the riskiest time of the year, a pre-spray of herbicide(s) may be used to kill and desiccate the aboveground portion of the plants. Especially in areas with little or no ground cover except Himalayan blackberry, the canes may need partial mowing or chopping to help carry fire. Used alone, this method (fire) will not prevent resprouting from root crowns" [185]. See Control for additional information on managing Himalayan blackberry infestations.

OTHER MANAGEMENT CONSIDERATIONS

SPECIES: Rubus armeniacus

- **FEDERAL LEGAL STATUS**
- **OTHER STATUS**

FEDERAL LEGAL STATUS

All blackberries in the *Rubus fruiticosus* complex, including Himalayan blackberry, are federally classified as noxious weeds [200].

OTHER STATUS

Himalayan blackberry is considered a noxious or invasive weed in many states (e.g., [22,36,61]), and in British Columbia and Ontario [43,47,76]. See the Plants Database for information on state-level legal status of Himalayan blackberry.

IMPORTANCE TO WILDLIFE AND LIVESTOCK

Mammals—including American black bears [87,132], grizzly bears [54], gray foxes [12], coyotes [185], and small mammals [65,122]—eat Himalayan blackberry fruits. The fruits also are an important food for passerine birds [4,10] such as mockingbirds, juncos, sparrows, and towhees [10]. Some invertebrates, such as slugs [80], also eat the fruits.

Browsing animals eat Himalayan blackberry foliage, although most ungulates do not prefer it. Elk, mule deer, white-tailed deer, and domestic goats browse the leaves [76,102,104,191], which have small prickles. Some insect species also browse the leaves, including the larvae of Lepidopterans [76]. The blackberry leafhopper is an obligate herbivore on blackberries, grapes, and roses, and Himalayan blackberry is its preferred host. It browses Himalayan blackberry leaves in its larval and adult stages, and the females lay their eggs on Himalayan blackberry leaves [159,161]. Other leafhopper species (blue-green sharpshooter leafhopper, grape leafhopper, and western grape leafhopper) [76,179] and leafcutter ants [174] also browse the leaves. In greenhouse and chamber studies in western Washington, nonnative black slugs browsed Himalayan blackberry leaves, although the leaves were not preferred. Native Pacific banana slugs avoided Himalayan blackberry leaves altogether [42], although they may eat Himalayan blackberry leaves in the wild [80].

Palatability and Nutritional Value: Browsing ungulates tend to avoid Himalayan blackberry stems because of the large prickles [94], although they may browse new shoots [122]. On two sites in the Cascade Range of Washington and a site in the Coast Ranges of Oregon, elk mostly avoided Himalayan blackberry forage. It comprised 2.5% of their total summer and fall diets [96]. In western Washington, mule deer browsed Himalayan blackberry leaves, but they avoided the stems [197].

Blackberry fruits are a good source of energy; fiber [2,4]; vitamins A, B, C, E, and K; nitrogen [2,4] and potassium [76]; and copper, manganese, and other trace minerals [2,4,76]. Additionally, the fruits are high in antioxidants [2,4,66,178]. For birds, the fruits are especially important during fall migration as a source of calories and antioxidants [4]. See these sources for detailed information on the nutritional content of Himalayan blackberry fruits: [12,66,197].

Cover Value: Many small wildlife species prefer the dense cover that Himalayan blackberry thickets provide [52,122,169]. Amphibians, including the federally endangered California red-legged frog, use the thickets for cover [70]. Himalayan blackberry thickets also provide cover for snakes, including the North America racer and northwestern garter snake [19]. In the San Juan Islands of Washington, a common sharp-tailed snake was discovered in a coastal manroot-Himalayan blackberry thicket. The snake is rare in Washington [151]. In a conifer-hardwood riparian forest in western Oregon, western pond turtles selected nesting sites where the understory was composed of Himalayan blackberry, black hawthorn, and Scotch broom [170].

Many bird species use Himalayan blackberry for nesting and hiding cover. Hummingbirds [76], quail [214], and passerines [52]—including fox sparrows [146], song sparrows [52,79,146,169], and tricolored blackbirds [50,92]—nest in Himalayan blackberry thickets. In the Central Valley of California, the state-protected tricolored blackbird had greater nesting success under Himalayan blackberry than under native cattails and bulrushes [50]. Along the Trinity River in California, yellow-breasted chats and yellow warblers selected sites where Himalayan blackberry cover was greater than expected by chance

[169]. In Muir Woods National Monument, California, Swainson's thrushes selected thickets with abundant Himalayan blackberry and twinberry honeysuckle fruits as brood-rearing areas. Fledglings used the thickets for cover, especially when first trying to fly [213].

Himalayan blackberry provides nesting and hiding cover for many small rodents, including nonnative black rats [65,212], Botta's pocket gophers, bushy-tailed woodrats [122], and California ground squirrels [214]. On the Consumnes River Preserve, California, black rats selected areas with dense cover of Himalayan blackberry, California blackberry, and California wild grape more often than expected based upon habitat availability. Seventy-five percent of black rat observations were in dens within Himalayan blackberry thickets [212]. Based on trapping success, black rats were more likely to reside within than outside of Himalayan blackberry thickets, which provided nesting cover and protection from predators [65].

OTHER USES

Himalayan blackberry is cultivated for its large, sweet fruits [76,116,193]. It is a major fruit crop in the Pacific Northwest [222] and Mexico [3]. Its drupes are the most widely picked fruit in wildlands [76]. Commercial cultivars are available [116]. Blackberries are eaten fresh and made into jam, jelly, and desserts [5]. Due to their relative hardiness, wild-type Himalayan blackberry plants are used in developing and improving commercial blackberry cultivars [154].

Himalayan blackberry fruits, and the bark of its stems and roots, are used in traditional medicines to cure a variety of ailments [222]. However, Himalayan blackberry often displaces native blackberries [90] and other culturally significant plant species, and can deter from cultural uses of desired habitats and plant species. For example, dense Himalayan blackberry thickets impede access to alder and willow shoots that are used in basketry [122].

Himalayan blackberry and other blackberry species are used in ethnoveterinary medicine as a tonic and to boost lactation in dairy animals [126].

IMPACTS

Himalayan blackberry is the most invasive of the blackberries in the *Rubus fruiticosus* complex [46]. It is listed as one of the 40 most invasive woody angiosperms worldwide, and in North America, it is the most invasive nonnative shrub on the West Coast [14,36,83] (table 3). It is considered the most widespread and economically disruptive of all the noxious weeds in western Oregon [6,14,36,83,164,187]. Forest Inventory Analysis data from 2001 to 2010 showed it was the most common nonnative shrub, and it was the most common of *all* nonnative species in moist areas, with an estimated 637 km^2 of total cover on forested lands [14]. Based on 2000 to 2001 FIA data gathered on the western slope of the Cascade-Sierra Nevada ranges, Himalayan blackberry occurred along 32% of forested foothill streambanks in California, along 21% in Oregon, and along 6% in Washington [168].

Table 3—Himalayan blackberry invasiveness rating in the United States

Area	Invasiveness rating
United States, overall	high [41]
Alaska, south coastal	likely to invade in future [41]
California	high [36]
Oregon	high; regionally abundant [153]

Himalayan blackberry can form large thickets that hinder movement of humans and large wildlife [22,103,104] and impede access to water [61]. It is highly competitive for space, light, and nutrients. Thickets grow quickly and produce a dense canopy that shades out and limits the growth of native plants [36,40,61,103,104,193], crushing them beneath the blackberry canopy [165,193]. Himalayan blackberry reduces plant biodiversity by preventing the establishment of shade-intolerant native plant species [22,104,106,119,185,214,222] such as ponderosa pine, Oregon white oak, and other oak species [185,214]. Himalayan blackberry often displaces native blackberries, raspberries [124,137] and other riparian shrubs [139], and it may replace native thickets [36]. Scoll (1994) noted that Himalayan blackberry [185]:

> "readily invades riparian areas, forest edges, oak woodlands, meadows, roadsides, clearcuts and any other relatively open area, including all open forest types. Once it becomes well established, Himalayan blackberry outcompetes low stature native vegetation and can prevent establishment of shade intolerant trees, leading to the formation of apparently permanent Himalayan blackberry thickets with little other vegetation present. The resulting dense thickets can limit movement of large animals from meadow to forest and vice versa, reducing the utility of small openings and meadows as foraging areas. Although the fruit is widely consumed by native animals, and some butterflies use Himalayan blackberry, it is a poor functional replacement for a diverse native forest understory, meadow or riparian floodplain" [185].

Himalayan blackberry invasion may directly or indirectly reduce oak seedling establishment, but it may increase recruitment of oaks in the sapling stage. On thicket edges in the Central Valley, Himalayan blackberry is sometimes a nurse plant for valley oak and other hardwoods [76]. A study in Shasta County, California, found that blue oak and valley oak seedling establishment was poor in the interior of Himalayan blackberry thickets in oak/annual grassland rangelands. However, because Himalayan blackberry protected oak seedlings from cattle damage, oak recruitment into the sapling stage was greater on the edges of Himalayan blackberry thickets than in the open [214]. Acorn reserves and consequent oak seedling recruitment may be reduced by rodent consumption, which may be elevated when rodent populations are high. Rodent fitness, reproductive success, and population size may increase when rodents eat the nutritious fruits of Himalayan blackberry; thus, fruiting Himalayan blackberry plants may indirectly reduce acorn availability [214]. Some of these rodents are nonnative and invasive (e.g., black rats) [65,212].

Himalayan blackberry is an agricultural and rangeland weed [187]. In Linn County, Oregon, Himalayan blackberry and prickly lettuce were the two fastest-spreading broad-leaved species in grass seed croplands [143]. In 2014, annual losses due to reductions in rangeland productivity due to invasive plant species were estimated at more than $85 million, with Himalayan blackberry and Scotch broom accounting for most losses [130]. Himalayan blackberry hosts two pathogens that also infect commercial grapes. Pierce's disease is caused by a bacterium (*Xylella fastidiosa*) that is spread by the bluegreen sharpshooter leafhopper, which feeds on blackberries and grapes [76]. Himalayan blackberry is an alternative host for the grapevine red blotch-associated virus, a pathogen that greatly reduces the quality and quantity of grape juice [11].

Himalayan blackberry may displace native plants. Himalayan blackberry's invasion success is aided by its adventitious rooting at primocanes tips (see Vegetative Regeneration); carbon acquisition [15,135,136] and rapid growth compared with that of many associated plant species (see Seedling Establishment and Plant Growth); and water- and nitrogen-use efficiency [38,39,40,76,135,136]. It typically has greater rates of vegetative growth and seed production compared to native shrubs [38,39]. For example, near Corvallis, Oregon, Himalayan blackberry cane production and sexual reproduction (when population density was high) was greater than that of California blackberry, suggesting its greater capacity to spread and establish in new locations compared to California blackberry [124,136]. On the McDonald-Dunn Research Forest, nonnative Himalayan blackberry and cutleaf blackberry had higher flowering and fruiting rates, higher photosynthetic capacities, longer growth periods, more efficient water use, and higher nitrogen acquisition compared to native California blackberry and white raspberry [135,136,137]. Himalayan blackberry also had higher growth rates than the native shrubs [39,76]. Additionally, ability to regulate leaf area based on light availability [39,40] (see Seedling Establishment and Plant Growth and Fuels), and regulate carbon acquisition based on water availability, likely allows Himalayan blackberry to colonize dry, well-drained sites such as gravel pits, fill sites, and steep slopes [39], tolerate low-nutrient soils, and outcompete plant species with higher soil moisture and/or nutrient requirements [40].

Himalayan blackberry can increase soil organic matter, creating a positive feedback loop wherein Himalayan blackberry litter increases the likelihood of population maintenance and spread. In western Oregon, Himalayan blackberry grows in substrates of gravel or fill that would have supported little vegetation prior to its colonization, suggesting that increases in soil organic matter content was a result, not a cause, of Himalayan blackberry presence. The authors concluded that "organic matter from *R. armeniacus* detritus may have increased the moisture content at our sites with coarse-textured substrates, which would help explain stand maintenance (but not necessarily establishment) at these sites" [37].

PREVENTION

Preventing Himalayan blackberry invasion is the most economically and ecologically effective management strategy. Himalayan blackberry is well adapted to establishing and spreading on open, often disturbed, sites (see Successional Status).

Maintaining the integrity of the native plant community and mitigating the factors that enhance ecosystem invasibility is likely to be more effective than solely controlling invaders such as Himalayan blackberry [101]. Minimizing soil disturbance (e.g., avoid road building in wildlands [196]), maintaining "healthy" natural communities [129,181], and monitoring several times each year [110] can help prevent its establishment, persistence, and spread. Weed prevention and control can be incorporated into many types of management plans, including those for logging and site preparation, grazing allotments, recreation management, research projects, road building and maintenance, and fire management [204]. See the Guide to noxious weed prevention practices [204] for specific guidelines in preventing the spread of weed seeds and propagules under different management conditions. See Fire Management Considerations for information on practices for preventing postfire establishment and spread of Himalayan blackberry.

CONTROL

Himalayan blackberry is very difficult to control [40,41,104] because its root crown and large, deeply buried rhizomes can support posttreatment sprouting for many years, and animal seed dispersal provides a ready source of new infestations (see Regeneration Processes). A rating of nonnative plant species in Alaska ranked Himalayan blackberry's difficultly to control as 9 out of 10, and its negative ecological impact as 38 out of 40 [41]. Top-killing Himalayan blackberry (via prescribed fire, mechanical, or other treatments) is an important first step in integrated management because it improves access to the bases of plants in dense thickets, which aids in subsequent control treatments [104]. Multiple entries (i.e., follow-up treatments) [53,76,186] for many years [186] are needed to control Himalayan blackberry, regardless of treatment method. Monitoring and repeated control treatments are particularly needed on sites where Himalayan blackberry has high probability of reestablishment, such as along rivers prone to flooding and in and near agricultural areas [110,186]. In all cases where invasive species are targeted for control, the potential for other invasive species to fill their void must be considered [28]. Control of biotic invasions is most effective when it employs a long-term, ecosystem-wide strategy rather than a tactical approach focused on battling individual invaders [129].

Fire: See the Fire Management Considerations section of this Species Review for information on using prescribed fire to control Himalayan blackberry.

Physical or Mechanical Control: Repeated cutting of aboveground Himalayan blackberry vegetation can be effective, but is expensive and requires multiple years of treatment [22,185]. Repeated cuttings of primocanes eventually exhausts the carbohydrate reserves stored in the roots and rhizomes [61]. Due to posttreatment sprouting, a single cutting may increase Himalayan blackberry density. Cut stems in contact with soils may root and reestablish, so pile burning or disposing of the stems is recommended [104].

Grubbing out the root crowns, major roots, and rhizomes can reduce Himalayan blackberry abundance. However, grubbing is expensive [185] and Himalayan blackberry prickles are painful [76], so it is practical only for controlling small infestations [104]. The most effective mechanical control is achieved with grubbing and repeated cutting [22]. Even so, mechanical treatments are unlikely to remove deeply buried Himalayan blackberry rhizomes [104].

Pulling or hoeing can help control small plants [104,185]. Pulling helped control Himalayan blackberry seedlings on the Chehalis River Surge Plain Natural Area Preserve in Washington [53].

Biological Control: Important considerations for developing and implementing biological control programs is available in the Weed control methods handbook [195] and in these sources: [206,216].

Introduction of nonnative fungi and other control organisms puts native *Rubus* species at risk, so research in this area is not supported by the USDA [104,185]. A rust native to Europe, *Phragmidium violaceum*, infects Himalayan blackberry and other blackberries. However, laboratory investigations concluded that the rust does not effectively control invasive blackberries, and Himalayan blackberry in particular is not susceptible to the rust [29,30]. In 2005, *P. violaceum* was identified on Himalayan blackberries along a 160-km stretch of the Oregon Coast [187].

Livestock Grazing: Domestic sheep, domestic goats, cattle, or horses can help control Himalayan blackberry by browsing or trampling [22,104,185]. Livestock are particularly useful in removing sprouts after stem removal treatments [104]. Among livestock species, domestic goats are most effective at Himalayan blackberry control [61,104,185], although they also eat desirable native vegetation [61]. In the Willamette Valley, either 2 consecutive years of intense, short-duration domestic goat browsing; two consecutive July mowings; or intense, short-duration goat browsing followed by July mowing the next year were equally effective in controlling Himalayan blackberry sprouts. Cover of native and nonnative perennial forbs increased

on all treated plots compared to untreated plots [105,106].

Chemical Control: Herbicides may be an effective step in controlling new invasions, but they are rarely a complete or long-term solution to weed management [34,104]. Control with herbicides is temporary, because it does not change conditions that allow infestations to occur in the first place (e.g., [221]). Herbicides are most effective on large infestations when incorporated into long-term management plans that include replacement of weeds with desirable species, careful land use management, and prevention of new infestations. See the Weed control methods handbook [195] for considerations on the use of herbicides in wildlands and detailed information on specific chemicals.

Himalayan blackberry can be controlled with herbicides [22,71,207], and herbicides can be used as a follow-up treatment after other control treatments [61,185,186]. Multiple applications are needed to control sprouts [104]. Herbicides can also be used to desiccate and increase flammability of Himalayan blackberry and other plants prior to prescribed fire [104] (see Fire Management Considerations). Particular caution is advised when selecting and using an herbicide in riparian zones, where the herbicide may impact aquatic organisms and can be distributed to unforeseen locations by running water [104].

Several authors [18,61,76,103,104,185] review use of herbicides on Himalayan blackberry. Bennett (2006) reviews use of herbicides in riparian areas [18].

MANAGEMENT UNDER A CHANGING CLIMATE

Increased levels of atmospheric carbon dioxide may favor Himalayan blackberry regeneration and spread [76,176] at the expense of native shrubs that are less efficient in acquiring carbon and other nutrients (see Impacts). Based on climate change models, the Center for Invasive Species and Ecosystem Health (2020) provides maps predicting future expansion of Himalayan blackberry in the United States [67].

Because Himalayan blackberry is a highly desirable garden plant, it is likely that under climate warming, it will establish and spread onto new wildland sites following its planting in urban and rural gardens that were formerly too cold to support it.

Rubus bifrons

Figure 11—*Rubus bifrons* floricane. Creative Commons image by Daderot.

INTRODUCTION

SPECIES: Rubus bifrons

FEIS Abbreviation
RUBBIF

Common Names
Himalayan blackberry
European blackberry
Himalaya berry
wild blackberry

Taxonomy
The scientific name of this blackberry is *Rubus bifrons* Vest ex. Tratt (Rosaceae) [68,74,81,107,113,166,208]. The morphology and genetics of *R. bifrons* and *R. armeniacus* are very similar [74], and some systematists consider them the same species, with *R. bifrons* the accepted name [74,107]. This Species Review treats the two taxa as separate species. Both belong to the *R. fruiticosus* complex (subgenus *Rubus*) [45,104,150], an aggregate of blackberry species that are native to Eurasia [6,46,76] and primarily reproduce vegetatively [45]. Both blackberries share the common name "Himalayan blackberry". To avoid confusion, *R. bifrons* is referred to by its scientific name in this Species Review, and "Himalayan blackberry" refers to *R. armeniacus*.

Hybrids: *Rubus bifrons* hybridizes with California blackberry [203] and cutleaf blackberry [13,46,203]. It may also hybridize with sawtooth blackberry [131].

Synonyms
None

Life Form
Shrub

Little information was available on *Rubus bifrons* ecology and response to fire in the scientific literature as of 2020, December (see FEIS's list of source literature). The following sections provide details from the available information. Because *R. bifrons* and Himalayan blackberry are closely related, information pertaining to Himalayan blackberry likely applies to *R. bifrons*.

DISTRIBUTION AND OCCURRENCE

SPECIES: Rubus bifrons

GENERAL DISTRIBUTION
Rubus bifrons is native to Europe [68,81,208] and western Asia [68]. Its date of introduction in the United States is uncertain [23]. In the United States, it occurs from southern New York and Massachusetts south to eastern Texas and central Georgia [58,203,208] (fig. 12). *Rubus bifrons* is not invasive in the eastern United States [23,81,98]; it is cultivated for its fruit and occasionally escapes cultivation [81,111]. It is mostly cultivated in the Southeast [81] and Texas [112]. In wildlands, it is uncommon to rare in the Northeast [81] and in Virginia, Tennessee, and the Carolinas [81,111,218]. As of 2010, it was documented in two counties in Kentucky [23].

Putative *R. bifrons* × cutleaf blackberry hybrids occur in coastal Oregon and California, and in Nevada County, California. Putative *R. bifrons* × California blackberry hybrids occur in San Joaquin County, California [203].

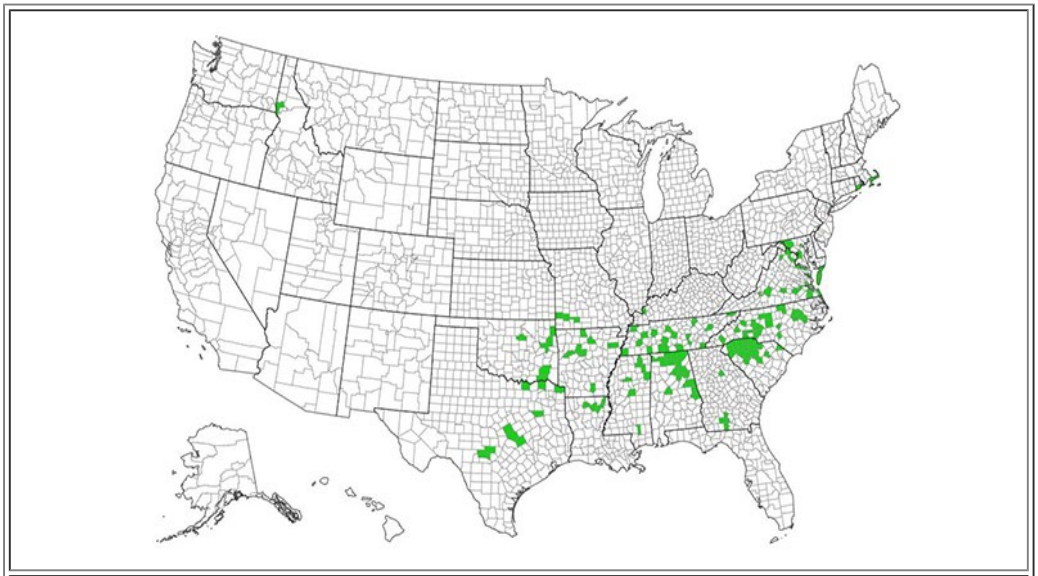

Figure 12—Distribution of *Rubus bifrons* in the United States. Map courtesy of EDDMaps [67] [2021, March 9].

States:
AL, AR, CT, DC, GA, KY, LA, MS, NJ, NY, MD, MA, MO, NC, PA, TN, TX, SC, VA [203]

SITE CHARACTERISTICS
Failure of *R. bifrons* to spread in the Northeast suggests that it does not tolerate cold climates. However, Rana (2007) reports that it is frost and drought tolerant in its native India [162].

Rubus bifrons occurs in disturbed areas [123,208] such as "waste" areas [184,218], fencelines, rights-of-way, roadsides, old fields, pastures, plantations [58,104,208], stream gullies, and riverbanks [104].

Rubus bifrons is an upland species [141,166]. Its occurrence in wetlands was undocumented as of 2020, although it occurs in riparian areas [104]. In 2016, it occupied large areas near the bases of shoreline bluffs on the south side of South Manitou Island, Michigan [166].

Boyce (2010) reports that *R. bifrons* tolerates a wide range of soil textures, fertility levels, and pH ranges but prefers moist, well-drained soils [23]. In Alabama, it grows on hills derived from limestone [121].

PLANT COMMUNITIES

Information on plant communities in which *R. bifrons* occurs was lacking in the literature as of 2020. See table A4 for a list of ecosystems in which it may occur.

BOTANICAL AND ECOLOGICAL CHARCTERISTISTICS

SPECIES: Rubus bifrons

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., [58,81]).

Rubus bifrons has arching, trailing stems [58,81] that are up to 1.5 m long [58]. Stems are heavily armed with recurved prickles [208,209]. Its flowering stems (floricanes) branch out from first-year, vegetative stems (primocanes) [58]. A Michigan flora describes *R. bifrons* as a "fiercely prickly", "aggressive plant" [166]. The leaves are deciduous [23] to semievergreen [74]. The inflorescence is a panicle of perfect flowers [58,209]; *R. bifrons* is noted for its numerous flowers [218]. The fruit is a fleshy drupe [58] consisting of an aggregate of tiny, one-seeded drupelets. Each drupelet contains a single, hard-coated nutlet [220]. *Rubus bifrons* is rhizomatous [76] and forms thickets [58,208].

Raunkiaer Life Form:

Phanerophyte
Geophyte [163]

SEASONAL DEVELOPMENT

The flowering and fruiting periods of *R. bifrons* are staggered [154,220], with flowers emerging intermittently in spring and summer and fruits ripening intermittently from summer to fall [220] (table 4). Seeds germinate in spring [76,104,185].

Rubus bifrons primocanes elongate in spring, completing growth by fall [58]. Primocanes die in late fall or winter [58,199,208] of their second [61,104] or third [104] year. Floricanes grow out from second- and third-year primocanes [61]. They remain short but grow small, lateral branches that produce flowers and fruits [58,185,199,208].

Table 4—Phenology of *Rubus bifrons*.

Area	Event
Blue Ridge Mountains	flowers May-June [218]
Northeast	flowers June-August [81]
Southeast	flowers May-June; fruits June-July [208]
Maryland	flowers May-June; fruits June-July [210]
Texas	flowers May-June [58,209]; fruits June-July [209]

REGENERATION PROCESSES

Blackberries, including *R. bifrons*, have one of the most versatile systems for reproduction, colonization, and colony maintenance among woody plants [222]. *Rubus bifrons* primarily reproduces vegetatively, although sexual reproduction and

seed dispersal are important for its spread [45,154]. It reproduces vegetatively by sprouting from its rhizomes and root crown, and by layering [45,154,222].

Rubus bifrons also reproduces sexually from seed and asexually from apomixis [13,45,46,63,120,154,222]. It is considered facultative pseudogamous apomictic because it produces seeds both sexually (from pollination) and asexually by apomixis (specifically agamospory, or formation of seeds without pollination and sexual fertilization) [13,45,46,63,120,154,222]. Most seeds develop apomictically, so genetic diversity of *R. bifrons* is low. Occasional sexual reproduction contributes to its genetic diversity [120].

Rubus bifrons is dioecious [222]. It is self- or cross-pollinated, with cross-pollination resulting in larger fruits and higher seed sets [120]. Good seed crops occur nearly every year [104,185], although *R. bifrons* generally does not produce fruits and seeds when growing in dense shade [104,185]. Seedlings require 3 years to produce flowering canes [124].

SUCCESSIONAL STATUS

Rubus bifrons tolerates light shade [23]. It grows on early-successional sites, such as old fields [208].

FIRE ECOLOGY AND MANAGEMENT

SPECIES: Rubus bifrons

FIRE ADAPTATIONS AND PLANT RESPONSE TO FIRE

A 2010 literature review found that information on the fire ecology, postfire response, and control of *R. bifrons* with fire was lacking [23]. The 2020 literature search revealed no further or new information. Because Himalayan blackberry and *R. bifrons* are so closely related and have similar methods of regeneration, information in the Fire Ecology and Management section for Himalayan blackberry may also apply to *R. bifrons*.

Postfire Regeneration Strategy:

Tall shrub with a sprouting root crown
Rhizomatous shrub, rhizome in soil
Geophyte, growing points deep in soil
Initial off-site colonizer (off site, initial community)
Secondary colonizer (on- or off-site seed sources) [189]

OTHER MANAGEMENT CONSIDERATIONS

SPECIES: Rubus bifrons

Federal Legal Status: All blackberries in the *R. fruiticosus* complex, including *R. bifrons*, are federally classified as noxious weeds [200].

Other Status: *Rubus bifrons* is listed on the Watch list for Kentucky and on the National Park Service, U.S. Department of Interior's Invasives list for the Mid-Atlantic and National Capital regions [67]. See the Plants Database for more information on the state-level legal status of *R. bifrons*.

Other Management Considerations: *Rubus bifrons* is rare and apparently not highly invasive in its current distribution.

Due to their relative hardiness, wild-type *R. bifrons* plants are used in developing and improving commercial blackberry cultivars. *Rubus bifrons* imparts drought and frost tolerance, and resistance to cane blight [162].

Browsing by domestic goats can help control *R. bifrons* regrowth after stem removal treatments [23]. Several authors [18,61,76,103,104,185] review use of herbicides on *R. bifrons*. Bennett (2006) reviews use of herbicides in riparian areas

[18].

Further research is needed on the taxonomy, fire ecology, and general ecology of *R. bifrons*.

APPENDIX

SPECIES: Rubus armeniacus, R. bifrons

Table A1—Common and scientific names of fungi and plants mentioned in this Species Review. Links go to other FEIS Species Reviews.

Common name	Scientific name
Fungi	
cane blight	*Leptosphaeria coniothyrium*
rust, no common name	*Phragmidium violaceum*
Ferns	
western swordfern	*Polystichum munitum*
Forbs	
prickly lettuce[a]	*Lactuca serriola*
rattlebox	*Sesbania punicea*
tansy ragwort[a]	*Senecio jacobaea*
yellow starthistle[a]	*Centaurea solstitialis*
white insideout flower	*Vancouveria hexandra*
Graminoids	
blue wildrye	*Elymus glaucus*
bristly dogstail grass[a]	*Cynosurus echinatus*
bulrushes	*Bolboschoenus* and *Schoenoplectus* spp.
California oatgrass	*Danthonia californica*
cattails	*Typha* spp.
Columbian sedge	*Carex aperta*
fescues	*Festuca* spp.
Kentucky bluegrass[a]	*Poa pratensis*
Pacific woodrush	*Luzula comosa*
reed canarygrass[a]	*Phalaris arundinacea*
tall fescue[a]	*Schedonorus arundinaceus*
tall oatgrass[a]	*Arrhenatherum elatius*
sedges	*Carex* spp.
spreading rush	*Juncus patens*

tufted hairgrass	*Deschampsia cespitosa*
Vine or liana	
California wild grape	*Vitis californica*
coastal manroot	*Marah oreganus*
grapes	*Vitis* spp.
Shrubs	
American black elderberry	*Sambucus nigra* subsp. *canadensis*
blackberries	*Rubus* spp., subgenus *Rubus (*syn. *Eubatus)*
black hawthorn	*Crataegus douglasii*
California blackberry	*Rubus ursinus*
California hazelnut	*Corylus cornuta* var. *californica*
common juniper	*Juniperus communis*
common snowberry	*Symphoricarpos albus*
cutleaf blackberry	*Rubus laciniatus*
goldenflower century plant	*Agave chrysantha*
Himalayan blackberry	*Rubus armeniacus*
Himalayan blackberry	*Rubus bifrons*
Lewis' mock orange	*Philadelphus lewisii*
Nootka rose	*Rosa nutkana*
Palmer's century plant	*Agave palmeri*
Pennsylvania blackberry	*Rubus pensilvanicus*
raspberries	*Rubus* spp., subgenus *Idaeobatus*
roses	*Rosa* spp.
salmonberry	*Rubus spectabilis*
Saskatoon serviceberry	*Amelanchier alnifolia*
sawtooth blackberry	*Rubus argutus*
Scotch broom	*Cytisus scoparius*
shrubby blackberry	*Rubus fruticosus*
silver sagebrush	*Artemisia cana*
thimbleberry	*Rubus parviflorus*
twinberry honeysuckle	*Lonicera involucrata*
whitebark raspberry	*Rubus leucodermis*
Trees	
alders	*Alnus* spp.
alligator juniper	*Juniperus deppeana*
Arizona sycamore	*Platanus wrightii*
Arizona walnut	*Juglans major*
black cottonwood	*Populus balsamifera* subsp. *trichocarpa*
bigleaf maple	*Acer macrophyllum*
boxelder	*Acer negundo*
California black oak	*Quercus kelloggii*
California sycamore	*Platanus racemosa*

coast Douglas-fir	*Pseudotsuga menziesii* var. *menziesii*
common fig	*Ficus carica*
Emory oak	*Quercus emoryi*
Fremont cottonwood	*Populus fremontii*
grand fir	*Abies grandis*
gray oak	*Quercus grisea*
incense-cedar	*Calocedrus decurrens*
northern California black walnut	*Juglans hindsii*
oaks	*Quercus* spp.
oracle oak	*Quercus* × *moreha*
Oregon ash	*Fraxinus latifolia*
Oregon white oak	*Quercus garryana*
peach	*Prunus persica*
ponderosa pine	*Pinus ponderosa* var. *benthamiana*, *Pinus ponderosa* var. *ponderosa*
red alder	*Alnus rubra*
redwood	*Sequoia sempervirens*
sandbar willow	*Salix interior*
shining willow	*Salix lucida*
Sitka willow	*Salix sitchensis*
subalpine fir	*Abies lasiocarpa*
valley oak	*Quercus lobata*
western hemlock	*Tsuga heterophylla*
western redcedar	*Thuja plicata*
white alder	*Alnus rhombifoliaa*
willows	*Salix* spp.
[a]Nonnative species.	

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

Common name	**Scientific name**
Gastropods	
Pacific banana slug	*Ariolimax columbianus*
black slug[a]	*Arion ater*
Insects	
bees	Hymenoptera
blackberry leafhopper	*Dikrella californica*
blue-green sharpshooter leafhopper	*Graphocephala atropunctata*
bumble bees	*Bombus* spp.
grape leafhopper	*Erythroneura variabilis*
ground-nesting bees	Andrenidae
honey bee	*Apis mellifera*

leafcutter ant	*Atta cephalotes*
leafcutting bees	Megachilidae
butterflies and moths	Lepidoptera
snipe flies	Rhagionidae
syrphid flies	Syrphidae
soldier beetles	Cantharidae
skipper butterflies	Hesperiidae
sweat bees	Halictidae
western grape leafhopper	*Erythroneura elegantula*
Amphibians	
California red-legged frog	*Rana draytonii*
Reptiles	
common sharp-tailed snake	*Contia tenuis*
North America racer	*Coluber constrictor*
northwestern garter snake	*Thamnophis ordinoides*
snakes	Serpentes
western pond turtle	*Actinemys marmorata*
Birds	
American robin	*Turdus migratorius*
emu[a]	*Dromaius novaehollandiae*
fox sparrow	*Passerella iliaca*
hummingbirds	Trochilidae
juncos	*Junco* spp.
mockingbirds	*Mimus* spp.
passerines	Passeriformes
quail	*Callipepla*, *Coturnix*, and *Oreortyx* spp.
song sparrow	*Melospiza melodia*
Swainson's thrush	*Catharus ustulatus*
towhees	Pipilo spp.
tricolored blackbird	*Agelaius tricolor*
sparrows	Emberizidae
yellow-breasted chat	*Icteria virens*
yellow warbler	*Setophaga petechia*
Mammals	
American badger	*Taxidea taxus*
American black bear	*Ursus americanus*
black rat[a]	*Rattus rattus*
Botta's pocket gopher	*Thomomys bottae*
bushy-tailed woodrat	*Neotoma cinerea*
California ground squirrel	*Otospermophilus beecheyi*
coyote	*Canis latrans*
elk	*Cervus elaphus*

common gray fox	*Urocyon cinereoargenteus*
grizzly bear	*Ursus arctos horribilis*
mule deer	*Odocoileus hemionus*
red fox	*Vulpes vulpes*
Virginia opossum	*Didelphis virginiana*
white-tailed deer	*Odocoileus virginianus*
[a]Nonnative species.	

Table A3—Representative plant communities in which Himalayan blackberry is invasive. It may also occur in other plant communities.
FRES Ecosystems
FRES20 Douglas-fir
FRES21 Ponderosa pine
FRES23 Fir-spruce
FRES24 Hemlock-Sitka spruce
FRES27 Redwood
FRES28 Western hardwoods
FRES29 Sagebrush
FRES30 Desert shrub [78]
Kuchler Plant Associations
K001 Spruce-cedar-hemlock forest
K002 Cedar-hemlock-Douglas-fir forest
K003 Silver fir-Douglas-fir forest
K004 Fir-hemlock forest
K005 Mixed conifer forest
K006 Redwood forest
K010 Ponderosa shrub forest
K011 Western ponderosa forest
K012 Douglas-fir forest
K015 Western spruce-fir forest
K025 Alder-ash forest
K026 Oregon oakwoods
K028 Mosaic of K002
K029 California mixed-evergreen forest
K030 California oakwoods
K038 Great Basin sagebrush
K043 Paloverde-cactus shrub
SAF Cover Types
206 Engelmann spruce-subalpine fir
211 White fir
213 Grand fir
221 Red alder

222 Black cottonwood-willow
223 Sitka spruce
224 Western hemlock
225 Western hemlock-Sitka spruce
226 Coastal true fir-hemlock
227 Western redcedar-western hemlock
228 Western redcedar
229 Pacific Douglas-fir
230 Douglas-fir-western hemlock
232 Redwood
233 Oregon white oak
234 Douglas-fir-tanoak-Pacific madrone
234 Douglas-fir-tanoak-Pacific madrone
237 Interior ponderosa pine
238 Western juniper
243 Sierra Nevada mixed conifer
244 Pacific ponderosa pine-Douglas-fir
245 Pacific ponderosa pine
246 California black oak
249 Canyon live oak
250 Blue oak-foothills pine
255 California coast live oak [69]
SRM (Rangeland) Cover Types
109 Ponderosa pine shrubland
110 Ponderosa pine-grassland
201 Blue oak woodland
202 Coast live oak woodland
203 Riparian woodland
408 Other sagebrush types: silver sagebrush
507 Palo verde-cactus [182]

Table A4—Ecosystems in which *Rubus bifrons* may occur.
FRES Ecosystems
FRES 12 Longleaf-slash pine
FRES13 Loblolly-shortleaf pine
FRES 14 Oak-pine
FRES15 Oak-hickory
FRES16 Oak-gum-cypress
FRES18 Maple-beech-birch [78]

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