Wisteria floribunda, W. sinensis

INTRODUCTORY

Chinese wisteria
Photo by Ted Bodner, Southern Weed Science Society, Bugwood.org

AUTHORSHIP AND CITATION:
Stone, Katharine R. 2009. Wisteria floribunda, W. sinensis. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2010, February 1].

FEIS ABBREVIATION:
WISFLO
WISSIN

NRCS PLANT CODE [39]:
WIFL
WISI

COMMON NAMES:
Japanese wisteria
Chinese wisteria

TAXONOMY:
The genus name for wisteria is *Wisteria* Nutt. (Fabaceae). This review summarizes information on the following

wisteria species:

Wisteria floribunda (Willd.) DC., Japanese wisteria [13,28]
Wisteria sinensis (Sims) DC., Chinese wisteria [1,13,28,47]

In this review, species are referred to by their common names, and "wisteria" refers to both species.

Hybrids: In the southeastern United States, the majority of wisteria plants growing outside of cultivation were hybrids of Chinese and Japanese wisteria [35,36].

SYNONYMS:
for ***Wisteria floribunda* (Willd.) DC.**:
Rehsonia floribunda (Willd.) Stritch [24]

for ***Wisteria sinensis* (Sims) DC.**:
Rehsonia sinensis (Sims) Stritch [24]

LIFE FORM:
Vine-liana

FEDERAL LEGAL STATUS:
None

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

DISTRIBUTION AND OCCURRENCE

SPECIES: Wisteria floribunda, W.sinensis

GENERAL DISTRIBUTION:
As their names imply, **Japanese** and **Chinese wisteria** are native to Japan and China, respectively [34]. **Chinese wisteria** was brought to the United States for horticultural purposes in 1816 [45], while **Japanese wisteria** was introduced around 1830 [30]. Wisterias are used extensively in the southern and mid-Atlantic states to adorn porches, gazebos, walls, gardens and parks, and most infestations in natural areas are the result of plants escaping from such settings [34]. As of 2009, distributional maps of the United States show wisterias concentrated in the southeast, with spotty distributions to the north and west. **Japanese wisteria** is found as far west as Texas, east to Florida, north to Maine, and west to Illinois. **Chinese wisteria** is found as far west as Texas, east to Florida, north to Vermont, and west to Michigan. **Chinese wisteria** also occurs in Hawaii. The high rate of hybridization in wisteria plants in the southeastern states [35,36] may make distribution maps for the individual species suspect. Plants Database provides current distribution maps for both **Japanese** and **Chinese wisteria**.

HABITAT TYPES AND PLANT COMMUNITIES:
Plant community associations of nonnative species are often difficult to describe accurately because detailed survey information is lacking, there are gaps in understanding of nonnative species' ecological characteristics, and nonnative species may still be expanding their North American range. Though known to have a broad distribution, as of 2009 there were very few published descriptions of plant communities in which either wisteria species occurs. Therefore, wisterias likely occur in plant communities other than those discussed here and listed in the Fire Regime Table.

Chinese wisteria was found at the forest edge at Mt. Vernon, Virginia, where most of the forest was described as mature oak-hickory (*Quercus* spp.-*Carya* spp.) [45]. Similarly, it occurred in the North Carolina Piedmont of Durham and Orange Counties in undisturbed sites dominated by a temperate cold-deciduous forest mixture of oaks and hickories. In this same region, **Chinese wisteria** also occurred in areas of disturbed forest and abandoned agricultural land dominated by an overstory of loblolly pine (*Pinus taeda*). It was found with a number of other nonnative species, including tree-of-heaven (*Ailanthus altissima*), mimosa (*Albizia julibrissin*), princesstree (*Paulownia tomentosa*), multiflora rose (*Rosa multiflora*), Chinese privet (*Ligustrum sinense*), and Japanese honeysuckle (*Lonicera japonica*) [18].

In a Washington D.C. park, **Chinese wisteria** occurred with the overstory tree species yellow-poplar (*Liriodendron tulipifera*), American beech (*Fagus grandifolia*), American elm (*Ulmus americana*), black locust (*Robinia psuedoacacia*), northern red oak (*Q. rubra*), and sycamore (*Platanus occidentalis*). It was itself being climbed by western poison-ivy (*Toxicodendron rydbergi*) and Virginia creeper (*Parthenocissus quinquefolia*) [26].

The presence of **Chinese wisteria** is listed as a problem in the restoration of bottomland hardwood forests in Mississippi [32], which may be part of the southern floodplain forest type, with dominant species such as black tupelo (*Nyassa sylvatica*), sweetgum (*Liquidambar* spp.), oaks, baldcypress (*Taxodium distichum*), and pines (*Pinus* spp.) [9]. **Chinese wisteria** also occurred in an old-growth forest remnant stand dominated by longleaf pine (*P. palustrus*), a particularly rare southeastern forest type [40].

The only published record of plant community associations for **Japanese wisteria** noted that it was found alongside other nonnative species in a New Jersey forest preserve dominated by oaks, American beech, and sugar maple (*Acer saccharum*) [41].

BOTANICAL AND ECOLOGICAL CHARACTERISTICS

SPECIES: Wisteria floribunda, W. sinensis

Chinese wisteria infestation
Photo by Randy Westbrooks, U.S. Geological Survey, Bugwood.org

GENERAL BOTANICAL CHARACTERISTICS:

- **Botanical description**
- **Raunkiaer life form**

Botanical description: This description provides characteristics that may be relevant to fire ecology and is not meant for identification. Keys for identification are available (e.g., [24]).

Both **Japanese** and **Chinese wisteria** are showy, woody, ornamental perennial vines that commonly climb, twine, or trail on the ground [21,34]. **Chinese wisteria** is also occasionally described as a shrub [8,19]. Both species have been observed 65 feet (20 m) high in the canopy [34], and there are records of vines 70 feet (21 m) long [21]. The species look similar to each other and can be difficult to distinguish because they hybridize [21,35]. One way to differentiate the species is by examining the direction of vine twining; **Chinese wisteria** vines twine clockwise, while **Japanese wisteria** vines twine counter-clockwise [22].

Roots: One flora describes **Chinese wisteria** roots as few but "deeply penetrating" [41].

Stems: Stems of older wisteria plants can grow 15 inches (38 cm) in diameter, and have infrequent, alternate branches [34].

Leaves: Compound leaves of wisterias are about 1 foot (0.3 m) in length and alternate along the stem. **Japanese wisteria** leaves consist of 13 to 19 leaflets, while **Chinese wisteria** leaves consist of 7 to 13 leaflets [34].

Flowers: Wisteria flowers are dangling and showy, blue-violet, and are borne on racemes. Racemes are 4 to 20 inches (10-50 cm) long and 3 to 4 inches (7-10 cm) wide. All **Chinese wisteria** flowers bloom at the same time, while **Japanese wisteria** flowers bloom in sequence, starting at the base [21].

Fruits: Wisteria fruits are velvety brown seed pods, 4 to 6 inches (10-15 cm) long, narrowed toward the base, with constrictions in the pods that separate the seeds [34]. Each pod contains 1 to 8 flat, round, brown seeds, each 0.5 to 1 inch (1.2-2.5 cm) in diameter [21].

Raunkiaer [27] life form:
Phanerophyte

SEASONAL DEVELOPMENT:
For both species, flowering occurs in spring (April-May) [34] and fruits are formed from July to November [21].

REGENERATION PROCESSES:

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

There is very little information available about the reproductive and regeneration strategies of wisterias. The information available suggests that although seeds are produced in favorable conditions, vegetative growth from rooting of vines and stolons is the main method of wisteria spread [17,30]. Following injury, **Japanese wisteria** sprouts from the stump and from root fragments [30].

Pollination and breeding system: Hummingbirds were observed visiting **Chinese wisteria** [25].

Seed production: No information is available on this topic.

Seed dispersal: Wisteria pods and seeds are large and heavy, which limits dispersal by birds and mammals [21,22]. Seeds are water-dispersed along riparian areas and can travel great distances this way [21,22,30,34].

Seed banking: No information is available on this topic.

Germination: No information is available on this topic.

Seedling establishment and plant growth: Canopy gap formation which occurs when wisteria topples a large tree favors the growth of wisteria seedlings [34] and existing wisteria plants [17]. Once established in an area, wisteria patches can potentially cover several acres (see Impacts). One review states that **Japanese wisteria** plants can grow for more than 50 years [30], while another paper states that individual vines of both species can live for more than100 years [35].

Vegetative regeneration: Although seeds are produced in favorable conditions, vegetative growth is the main method of wisteria spread [17,30]. Reviews describe vines [21,22] and stolons [21,34] rooting at nodes. One review also notes the ability of **Japanese wisteria** to sprout repeatedly after mechanical damage, either from the stump or from any fragment of root system left in the ground [30]. Rates and distances of spread are not known, though individual vines have been documented at over 70 feet (21 m) long [21].

SITE CHARACTERISTICS:
Wisterias form dense infestations that spread from horticultural plantings [21,35]. They tend to establish and spread in forest edges, disturbed areas, and riparian zones [35], as well as roadsides, ditches, and rights-of-way [30]. Wisterias grow best in full sun but are tolerant of shade [17,30].

Soil: One review states that wisterias tolerate a variety of soil and moisture levels in the southeastern United States [35]. In Virginia, both species are listed as occurring on mesic sites [42]. In the southeastern United States, **Japanese wisteria** tolerates a variety of soil and moisture regimes but prefers loamy, deep, and well-drained soil [30]. One flora from the Southwest indicates that **Chinese wisteria** prefers deep, rich soil [41]. At Fire Island National Seashore, Suffolk County, New York, an isolated **Chinese wisteria** shrub was found growing in moist sand along a bayshore [8].

Climate: Two studies offered limited climate data for locations with **Chinese wisteria**. At Fire Island National Seashore, Suffolk County, New York, the mean annual temperature was 50 ºF (10 ºC) and annual precipitation was approximately 45 inches (1143 mm) [8]. In Durham and Orange Counties in North Carolina, mean daily maximum temperatures of 88.7 ºF (31.5 ºC) occurred in July, and mean daily minimum temperatures of 29.8 ºF (-1.2 ºC) occurred in January. Annual precipitation was 41 inches (1,052 mm) [18].

Elevation: **Chinese wisteria** occurs at 3,000 to 3,500 feet (900-1,000 m) in Bolivia [12]. Elevation ranges for wisterias in North America were not found in the available literature (2009).

Flooding: **Chinese wisteria** is considered problematic in bottomland hardwood forests, a plant community which experiences frequent flooding [32].

SUCCESSIONAL STATUS:
Wisterias grow best in full sun but are capable of tolerating and reproducing in partial shade [30,35,42]. While **Chinese wisteria** has been observed on the edge of mid- and late-successional forests [45], occurrence within the forest interior is not well-documented. The ability of wisterias to spread vegetatively suggests that they could move into the forest interior if favorable light conditions were created through disturbances. Observations of **Japanese wisteria** climbing surrounding vegetation in the direction of sunlight [30] suggest that this vine may spread and fill in canopy gaps as they are created.

Once established in an area, wisterias may persist for a long time and eventually alter successional pathways for the area they inhabit. It has been repeatedly noted that infestations of wisteria are so dense that they strangle or shade out

existing vegetation and displace native species [30,34,35]. Heavy infestations that topple large canopy trees and increase sunlight to the forest floor could favor colonizing species, including wisteria seedlings [34].

Because wisterias typically use other vegetation as support, it is not clear what their response would be following a disturbance that removed all potential supporting vegetation.

FIRE EFFECTS AND MANAGEMENT

SPECIES: Wisteria floribunda, W. sinensis

FIRE EFFECTS:

Immediate fire effect on plant: As of this writing (2009), there was no available literature that described the immediate effects of fire on either wisteria species. It is possible that severe fire may kill entire mature plants, although this response has not been documented. Because **Japanese wisteria** sprouts from the stem and root fragments after mechanical treatments [30], wisteria plants might also sprout after fire. As of 2009, no information was available on fire effects on or heat tolerance of wisteria seeds.

Postfire regeneration strategy [33]:
Prostrate woody plant, stem growing in organic soil
Initial off-site colonizer (off site, initial community)

Fire adaptations and plant response to fire: There was very little information (as of 2009) regarding specific adaptations of wisterias to fire. The ability of **Japanese wisteria** to sprout repeatedly from the stem and root fragments following mechanical treatments [30] (see Physical and/or mechanical control) suggests that either species would have the ability to sprout after fire if those parts were not subjected to lethal temperatures.

The dispersal characteristics of wisteria seeds suggest that seedlings would be unlikely to establish in postfire habitats unless there was an immediately adjacent riparian area or a source population of wisteria. Because seed bank information is lacking for wisterias, it is not known whether they might establish from a seed bank after fire.

FUELS AND FIRE REGIMES:

Fuels: As of 2009, no studies specifically addressed fuel characteristics of wisterias. One review suggests that **Chinese wisteria**, along with a number of other invasive vines, has the potential to alter the fuel characteristics of invaded communities. Specifically, invasive vines could increase fuel loading and continuity, and contribute to the likelihood of crown fire by acting as a ladder fuel [7]. The density, spatial extent, and climbing nature of wisteria populations suggest that they may alter fuel characteristics in invaded communities.

Fire regimes: It is not known what type of fire regime wisterias are best adapted to. In North America, they are found in plant communities that experience both long (e.g., northern hardwood, southern floodplain forests) and short (e.g., oak-hickory-pine communities) fire-return intervals (see Fire Regime Table). In many areas where wisterias occur, historic fire regimes have been dramatically altered due to fire exclusion and massive disturbances associated with human settlement, and the potential natural vegetation may be difficult to discern.

It is unclear how the presence of wisterias may affect fire regimes in invaded communities. In ecosystems where wisterias replace plants with similar fuel characteristics, they may alter fire intensity or slightly modify an existing fire regime. If wisteria spread introduces novel fuel properties to the invaded ecosystem, fire behavior, and potentially fire regime, may be altered (see: [4,6]). This topic warrants additional study.

FIRE MANAGEMENT CONSIDERATIONS:
Potential for postfire establishment and spread: As of 2009, no studies documented the establishment or spread of either wisteria species after fire. The large seed size and consequent lack of long-distance dispersal suggest that it would be difficult for wisterias to establish by seed unless the fire occurred near a riparian area or a source population of wisteria. However, the ability for the species to spread vegetatively, combined with a preference for sunny environments [17,30], suggests that wisterias may be problematic in postfire habitats if intact populations are nearby.

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 can be accomplished through early detection and eradication, careful monitoring and followup, and limiting dispersal of invasive plant propagules into burned areas. Specific recommendations 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 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: [2,5,10,38].

Use of fire as a control agent: As of 2009, there were no studies that tested the efficacy of using fire to control wisteria populations.

MANAGEMENT CONSIDERATIONS

SPECIES: Wisteria floribunda, W. sinensis

IMPORTANCE TO WILDLIFE AND LIVESTOCK:
As of 2009, there was very little information on the importance of wisteria to wildlife or livestock.

Palatability and/or nutritional value: A number of reviews list wisteria flowers, leaves, fruits, and seeds as poisonous [3], and one further indicates that seed ingestion causes symptoms such as nausea, vomiting, stomach pains, and diarrhea [17]. **Japanese wisteria** was listed as a minor winter plant food for bobwhite quail in Alabama [31], and hummingbirds have been observed feeding on the nectar of **Chinese wisteria** [25].

Cover value: No information is available on this topic.

OTHER USES:
One review describes uses for lectins and resins derived from **Chinese wisteria** [3].

IMPACTS AND CONTROL:
Impacts: Information regarding the impacts of wisterias on invaded communities includes evidence that both species displace existing vegetation by strangling or shading out native plants and trees [17,21,30,34,35]. The death of large trees from wisteria establishment results in breaks in closed canopy forest, which favors further growth and spread of wisteria [17]. Once established in an area, wisteria patches can potentially cover several acres; one herbicide experiment in Alabama was conducted in a **Chinese wisteria** patch that covered 2 to 3 acres (1 ha) [22]. The presence of **Chinese wisteri**a was listed as a problem in the restoration of bottomland hardwood forests in Mississippi [32] and threatens old-growth remnant stands of longleaf pine in the Southeast [40]. **Chinese wisteria** is also listed as occurring on National Wildlife Refuges in Florida [16].

While both wisteria species are listed as invasive species of concern in a number of states, information as of 2009 suggests that they are less of a perceived threat than other, co-occurring invasive species [23,29,37,44]. For example, in a paper describing woody invaders of eastern forests, **Japanese** and **Chinese wisteria** are not considered as much of a threat as other woody vines, including Oriental bittersweet (*Celastrus orbiculatus*), Japanese honeysuckle (*Lonicera japonica*), or kudzu (*Pueraria montana*) [44]. However, that status may change in the future.

Control: In all cases where invasive species are targeted for control, the potential for other invasive species to fill their void must be considered, no matter what method is employed [5]. Information presented in the following sections may not be comprehensive and is not intended to be prescriptive in nature. It is intended to help managers understand the ecology and control of wisterias in the context of fire management. For more detailed information on control of **Japanese** or **Chinese wisteria**, consult the references cited here or local extension services.

Fire: For information on the use of prescribed fire to control this species see Fire Management Considerations.

Prevention: No information is available on this topic.

Cultural: No information is available on this topic.

Physical and/or mechanical: One review outlines strategies for cutting climbing or trailing vines of **Japanese wisteria**. Wisteria can sprout numerous times after cutting, so the treatment must be repeated until root stores are exhausted. If done approximately every 2 weeks from spring until autumn, cutting prevents seed production and strangulation of surrounding vegetation. This type of treatment is appropriate for small populations, as a pre-treatment for large, impenetrable sites, or in areas where herbicides are not appropriate [30].

It is also possible to try to control juvenile or isolated **Japanese wisteria** plants using a pulaski or similar digging tool to remove the entire plant, including all roots and runners. Any portions of the root system not removed are capable of sprouting. This treatment is appropriate for small initial populations or areas where herbicide use is not feasible [30].

Biological: No information is available on this topic.

Chemical: A range of foliar spray herbicides has been effectively used for wisteria control [22,30], though high rates and repeated applications were needed to produce near-eradication [22] and it was possible to damage non-target species with treatment. Cut-stump application of glyphosate or triclopyr 2 inches (5 cm) above ground level was also found to be effective for **Japanese wisteria** control, though foliar spray treatments may be needed afterward to compensate for the stimulation of wisteria seedlings after large vine removal [30]. Care must be taken when other invasive species are present; in one herbicide treatment, the reduction in **Chinese wisteria** cover released the invasive Chinese privet (*Ligustrum sinense*), which was not impacted by the herbicides [22].

Integrated management: No information is available on this topic.

APPENDIX: FIRE REGIME TABLE

SPECIES: Wisteria floribunda, W. sinensis

This Fire Regime Table summarizes characteristics of fire regimes for vegetation communities in which **Japanese** or **Chinese wisteria** may occur based on descriptions in available literature and from inferences based on county distribution records found in the Plants Database. Follow the links in the table to documents that provide more detailed information on these fire regimes. This table does not include plant communities across the entire range of either wisteria. For information on other plant communities in which wisterias may occur, see the complete FEIS Fire Regime Table.

Fire regime information on vegetation communities in which Japanese and Chinese wisteria may occur. This information is taken from the LANDFIRE Rapid Assessment Vegetation Models [15], 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.

Southeast Great Lakes Northeast South-central US Southern Appalachians

Great Lakes

- 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 Forested					
Northern hardwood maple-beech-eastern hemlock	Replacement	60%	>1,000		
	Mixed	40%	>1,000		
Oak-hickory	Replacement	13%	66	1	
	Mixed	11%	77	5	
	Surface or low	76%	11	2	25

Northeast

- Northeast Woodland
- Northeast Forested

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

			(years)	(years)	(years)
Northeast Woodland					
Pine barrens	Replacement	10%	78		
	Mixed	25%	32		
	Surface or low	65%	12		
Northeast Forested					
Northern hardwoods (Northeast)	Replacement	39%	≥1,000		
	Mixed	61%	650		
Appalachian oak forest (dry-mesic)	Replacement	2%	625	500	≥1,000
	Mixed	6%	250	200	500
	Surface or low	92%	15	7	26

South-central US

- South-central US Grassland
- South-central US Forested

Vegetation Community (Potential Natural Vegetation Group)	Fire severity*	Fire regime characteristics			
		Percent of fires	Mean interval (years)	Minimum interval (years)	Maximum interval (years)
South-central US Grassland					
Bluestem-sacahuista	Replacement	70%	3.6	1	
	Mixed	30%	7.7	2	
South-central US Forested					
Southern floodplain	Replacement	42%	140		
	Surface or low	58%	100		

Southern Appalachians

- Southern Appalachians Forested

Vegetation Community (Potential Natural Vegetation Group)	Fire severity*	Fire regime characteristics			
		Percent of fires	Mean interval (years)	Minimum interval (years)	Maximum interval (years)
Southern Appalachians Forested					
	Replacement	3%	180	30	500
	Mixed	8%	65	15	150

Appalachian oak-hickory-pine					
	Surface or low	89%	6	3	10
Appalachian oak forest (dry-mesic)	Replacement	6%	220		
	Mixed	15%	90		
	Surface or low	79%	17		

Southeast

- Southeast Shrubland
- Southeast Woodland
- Southeast Forested

Vegetation Community (Potential Natural Vegetation Group)	Fire severity*	Fire regime characteristics			
		Percent of fires	Mean interval (years)	Minimum interval (years)	Maximum interval (years)
Southeast Shrubland					
Pocosin	Replacement	1%	>1,000	30	>1,000
	Mixed	99%	12	3	20
Southeast Woodland					
Longleaf pine/bluestem	Replacement	3%	130		
	Surface or low	97%	4	1	5
Longleaf pine (mesic uplands)	Replacement	3%	110	40	200
	Surface or low	97%	3	1	5
Longleaf pine-Sandhills prairie	Replacement	3%	130	25	500
	Surface or low	97%	4	1	10
Southeast Forested					
Coastal Plain pine-oak-hickory	Replacement	4%	200		
	Mixed	7%	100		
	Surface or low	89%	8		
Mesic-dry flatwoods	Replacement	3%	65	5	150
	Surface or low	97%	2	1	8
Loess bluff and plain forest	Replacement	7%	476		
	Mixed	9%	385		
	Surface or low	85%	39		

Southern floodplain	Replacement	7%	900		
	Surface or low	93%	63		

*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 [11,14].

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