

Nandina domestica

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INTRODUCTORY

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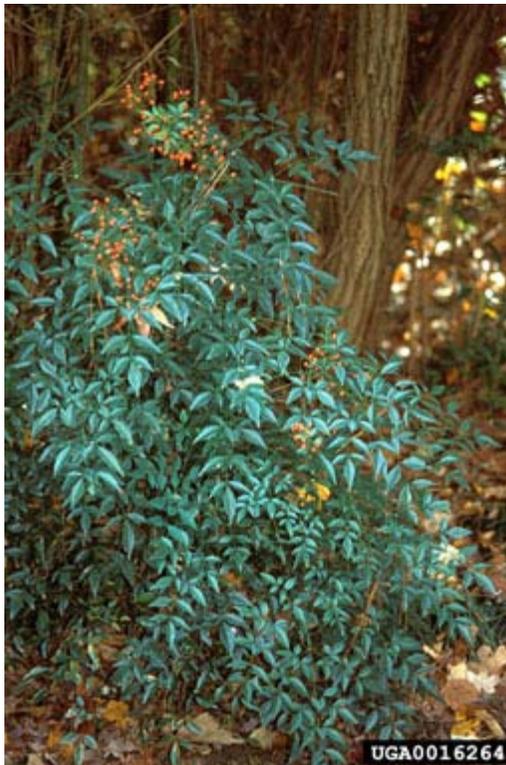


Photo by James H. Miller, USDA Forest Service, Bugwood.org

AUTHORSHIP AND CITATION:

Stone, Katharine R. 2009. *Nandina domestica*. 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/> [2009, December 17].

FEIS ABBREVIATION:

NANDOM

NRCS PLANT CODE [70]:

NADO

COMMON NAMES:

sacred bamboo
sacred-bamboo
heavenly bamboo
heavenly-bamboo
nanten
nandina

TAXONOMY:

The scientific name of sacred bamboo is *Nandina domestica* Thunberg (Berberidaceae) [[23,35](#)].

Many sacred bamboo cultivars exist [[15,18,34,50](#)].

SYNONYMS:

None

LIFE FORM:

Shrub

DISTRIBUTION AND OCCURRENCE

SPECIES: *Nandina domestica*

- [GENERAL DISTRIBUTION](#)
- [HABITAT TYPES AND PLANT COMMUNITIES](#)

GENERAL DISTRIBUTION:

Sacred bamboo is native to Asia, occurring in India, Japan, and China [[23](#)]. It was introduced to North America through cultivation as an ornamental [[14,23,50,79](#)] in the early 1800s ([[12](#)], review by [[5](#)]), escaping cultivation in some areas ([[14,26,50,74,79](#)], review by [[39](#)]). As of this writing (2009), sacred bamboo has a limited distribution in the southeastern United States, occurring from Texas east to Florida and north to Virginia. Forest Inventory and Analysis (FIA) data from forests in 12 southern states detected it in forests in 9 states, with highest estimated coverage in forests of Tennessee [[51](#)].

Estimated acres covered by sacred bamboo in forests in the southern United States, summed from subplots within each state using the Southern Research Station's FIA database from 15 March 2008 [51].											
AL	AR	FL	GA	KY	LA	MS	NC	SC	TN	TX	VA
4,553	470	82	191	0	4,966	1,008	0	674	9,237	1,233	0

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4,553	470	82	191	0	4,966	1,008	0	674	9,237	1,233	0

Because sacred bamboo occurs in plant communities other than forests inventoried by the Southern Research Station, overall state distributional patterns likely differ from those suggested from these data. [Plants Database](#) provides a distribution map of sacred bamboo.

HABITAT TYPES AND PLANT COMMUNITIES:

Sacred bamboo occurs in several plant communities in the southeastern United States. High densities of sacred bamboo are reported in upland hardwood and upland mixed forests in northern Florida, floodplain forests in Georgia, and slope woodlands in Texas. There is little published information regarding sacred bamboo occurrence, and most information presented here is from individual observations; it is likely that sacred bamboo occurs in plant communities not described here. The following descriptions of plant communities where sacred bamboo occurs are organized by state.

Florida: Several sources describe sacred bamboo in upland hardwood forests in Florida ([12], personal communications [3,42,43]). Sacred bamboo was frequent in undisturbed and disturbed upland hardwood forests in northern Florida. Undisturbed upland hardwood forests contained southern magnolia (*Magnolia grandiflora*), southern redcedar (*Juniperus silicicola*), water oak (*Q. nigra*), sweetgum (*Liquidambar styraciflua*), spruce pine (*Pinus glabra*), and hickories (*Carya* spp.). Disturbed upland hardwood forests contained similar overstory species but had a more developed understory, including the nonnative species Chinese privet (*Ligustrum sinense*), autumn-olive (*Elaeagnus umbellata*), and coral ardisia (*Ardisia crenata*) [12].

Sacred bamboo also occurs in upland mixed forests in Florida ([12], personal communications [3,42,64]). Sacred bamboo occurred in high densities in disturbed upland mixed forests in northern Florida, where dominant overstory species included sweetgum, red maple (*Acer rubrum*), boxelder (*A. negundo*), water oak, swamp chestnut oak (*Q. michauxii*), and Carolina laurelcherry (*Prunus caroliniana*), with some loblolly pine (*Pinus taeda*) and longleaf pine (*P. palustris*). The forest had numerous streams and was frequently flooded [12]. In the same region, sacred bamboo occurred sporadically with Chinese privet and glossy privet (*L. lucidum*) in upland mixed forest (personal communication [3]).

Sacred bamboo also occurs in mesic hammock plant communities in Florida ([25], personal communications [42,49]). In the north-central panhandle of Florida, sacred bamboo was infrequent in mesic hammock plant communities with a canopy of live oak (*Q. virginiana*), laurel oak (*Q. laurifolia*), sweetgum, white ash, pignut hickory, and southern magnolia (personal communication [49]). On the Florida panhandle, sacred bamboo was infrequent in second-growth hammock forests dominated by Darlington oak (*Q. hemisphaerica*), spruce pine, and American beech (*Fagus grandifolia*) [25].

Managers in Florida describe sacred bamboo in a variety of other plant communities (personal communications [3,42,43,64]). Sacred bamboo occurs in slope forest [42,43,64], seepage slope [42], floodplain forest [3,42], bottomland forest [64], maritime hammock [42], and calcareous bluff plant communities [3,43] in Florida. There are isolated invasive plant inventory records of sacred bamboo occurring in xeric hammock, sandhill, upland pine forest, and mesic flatwood plant communities [42].

Georgia: In southern Georgia, sacred bamboo was dominant in a floodplain forest and widespread but scattered in most forested areas close to human habitations near Atlanta (personal communication [29]). Sacred bamboo also occurred in southern mixed hardwood (or hammock) forests along riparian corridors. Species composition and dominance were highly variable, though pines (*Pinus* spp.), oaks (*Quercus* spp.), sugarberry (*Celtis laevigata*), American elm (*Ulmus americana*), and sugar maple (*A. saccharum*) were characteristic species [27]. In southwestern Georgia, sacred bamboo occurred at old home sites within the longleaf pine-pineland threeawn (*Aristida stricta*) plant community [20].

Louisiana: In southeastern Louisiana, sacred bamboo occurred in a shady alluvial forest near a forested wetland (personal communication [21]).

North Carolina: Sacred bamboo occurred infrequently in urban riparian mixed hardwood forests in central North Carolina. Dominant canopy species included American sycamore (*Platanus occidentalis*), red maple (*Acer rubrum*), yellow-poplar (*Liriodendron tulipifera*), sweetgum, oaks, and hickories. Many other nonnative species were present, most notably English ivy (*Hedera helix*) and Japanese stiltgrass (*Microstegium vimineum*) [72]. In south-central North Carolina, sacred bamboo occurred rarely in ruderal habitats within longleaf pine-pineland threeawn plant communities [60].

Tennessee: In central Tennessee, sacred bamboo was scattered throughout calcareous oak-hickory-juniper (*Juniperus* spp.) plant communities on limestone slopes and limestone bluffs. It also occurred in urban thickets surrounding residential areas, as well as open areas (e.g., along fencerows). In eastern Tennessee near Knoxville, sacred bamboo occurred in rocky, shady forests containing acidophilic oaks and hickories, yellow-poplar, and blueberry (*Vaccinium* sp.) in the understory (personal communication [21]).

Sacred bamboo was a scattered and infrequent species in the Maryville College Woods, a second-growth forest in eastern Tennessee. Community dominants included southern red oak (*Q. falcata*), pignut hickory (*Carya glabra*), mockernut hickory (*C. tomentosa*), yellow-poplar, black tupelo (*Nyssa sylvatica*), and sugar maple, with flowering dogwood (*Cornus florida*) common in the understory. The forest was considered heavily disturbed and contained many nonnative species in addition to sacred bamboo (personal communication [66]).

In Tennessee, sacred bamboo occurred in a late-successional, shaded ravine oak-hickory plant community (personal communication [21]) and was infrequent in "secondary growth" mixed-hardwood forests (personal communication [24]).

Texas: Sacred bamboo established in limestone canyonlands in central Texas, blocking sunlight to other plants in rich, diverse slope woodlands [55].

Virginia In Virginia, sacred bamboo occurred infrequently in urban forests, with no reports of establishment in rural forests (personal communication [75]).

BOTANICAL AND ECOLOGICAL CHARACTERISTICS

SPECIES: *Nandina domestica*

- [GENERAL BOTANICAL CHARACTERISTICS](#)
- [SEASONAL DEVELOPMENT](#)
- [REGENERATION PROCESSES](#)
- [SITE CHARACTERISTICS](#)
- [SUCCESSIONAL STATUS](#)

GENERAL BOTANICAL CHARACTERISTICS:

- [Botanical description](#)
- [Raunkiaer life form](#)

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., [14,17,56,79]).

Aboveground description: Sacred bamboo is an evergreen, glabrous shrub, growing to about 7 feet (2 m) tall, with relatively slender, unbranched or few-branched stems [26]. It grows in multistemmed clumps (review by [39]), superficially resembling bamboo (Tribe *Bambuseae*) (review by [50]). Sacred bamboo plants in northern Florida had 1 to 11 stems [12].

Sacred bamboo leaves are approximately 20 inches (50 cm) long and 30 inches (80 cm) wide, compound, alternate, somewhat lacy, and closely arranged near the ends of stems or branches [26]. Flowers are white to pinkish, borne in terminal clusters (review by [50]). Sacred bamboo fruits are red to purplish berries, each containing 1 to 3 seeds [23].



Sacred bamboo fruit.

Belowground description: Sacred bamboo produces a large root mass ([26], personal communications [44,59]), and 1 review states that it has a substantial taproot [34]. There are accounts of sacred bamboo regenerating from rhizomes ([12,18,26], reviews by [39,45]), though 1 flora states that it does not have rhizomes [23]. See [Vegetative regeneration](#) for more information on this topic.

Population density and structure: Most sources document sacred bamboo as occurring in a scattered ([12,21], personal communications [21,29,64,66]) or infrequent ([26,56], personal communications [24,49]) distribution, or as growing in small patches (personal communication [54]). Sacred bamboo was infrequent or rare in descriptions of plant communities in Florida ([25], personal communications [42,49]), North Carolina [60,72], Tennessee (personal communications [21,66]), and Virginia (personal communication [75]). On forested slopes in central Tennessee, approximately 25 individual sacred bamboo plants were scattered over a 1,000 ft² (100 m²) area (personal communication [21]). In a second-growth forest in eastern Tennessee, it was estimated that sacred bamboo covered <1% of the 120-acre (50-ha) forest (personal communication [66]).

High densities of sacred bamboo are not well documented, with most reports coming from managers in Florida. Dense monocultures are noted near early introduction sites in northern Florida [12], particularly at some state parks ([12], review by [39], personal communication [33]). At Three Rivers State Park in the north-central Florida panhandle, sacred bamboo occurred in clumps covering approximately 1 acre (0.4 ha) (personal communication [33]). In the same region at Maclay Gardens State Park, some localized populations of sacred bamboo reached "appreciable densities", with 12 to 24 individuals observable within the field of vision inside intact forest stands (personal communication [64]). One manager reported that sacred bamboo populations in Florida may reach a density of up to hundreds of stems per acre if left untreated (personal communication [43]). Sacred bamboo dominated the understory of floodplain forests in southern Georgia (personal communication [29]), and established in high enough densities to block sunlight to native species in slope woodlands in Texas [55].

Life span: It is not known how long most sacred bamboo plants live. Individual plants near homesites in the southern United States were >100 years old [18].

Raunkiaer [57] life form:

[Geophyte](#)

SEASONAL DEVELOPMENT:

Sacred bamboo flowers from May to June [17,23,50,56]. Fruiting dates range from September to April in the southern United States [23,50,56]. Seeds ripen in late winter and germination occurs the following fall, with 2 cold periods required to stimulate embryo development [16]. New leaf and stem growth occurs from February to April as well as from October to December [12].

REGENERATION PROCESSES:

Sacred bamboo appears to have the capacity for vegetative regeneration, but the prevalence of this regeneration strategy is not well documented. Some sources report that reproduction by seed is a more common and likely form of reproduction.

- [Pollination and breeding system](#)
- [Seed production](#)
- [Seed dispersal](#)
- [Seed banking](#)
- [Germination](#)
- [Seedling establishment and plant growth](#)

- [Vegetative regeneration](#)

Pollination and breeding system: No information is available on this topic.

Seed production: Though one source reports that plants as young as 18 months can produce numerous fruits [12], other sources suggest that it takes several years for sacred bamboo to reach maturity (personal communications [49,65]). When mature, sacred bamboo produces a heavy fruit crop (review by [5]), producing hundreds of fruits per plant (review by [12]). Seeds remain on the plant for several months (review by [45]).

Seed dispersal: Sacred bamboo seeds are dispersed by birds ([52], reviews by [5,34,39], personal communication [43]) such as northern mockingbirds, northern cardinals, cedar waxwings, and American robins (review by [39]), and mammals (reviews by [5,39], personal communication [43]) including the Virginia opossum (review by [39]), northern raccoon (review by [39], personal communication [43]), and rodents (personal communication [43]). They may also be dispersed by water [52].

Seed banking: Sacred bamboo seeds may remain dormant in the soil seed bank for at least 1 year ([12], review by [39]), as 2 cold periods are needed to stimulate stages of embryo development [16]. It is not known if sacred bamboo seeds persist longer than a year in the soil seed bank.

Germination: Sacred bamboo germination is difficult to induce under artificial conditions (review by [39]). In germination trials, neither treatment with gibberellic acid nor warm stratification improved sacred bamboo seed germination. Cold stratification improved germination rates and shortened germination time [16]. A horticultural handbook states that application of chloroform and leaching broke dormancy in seeds [53]. Sacred bamboo seeds collected in March, April, and May in Georgia exhibited 70% to 80% germination after 6 to 8 weeks [18].

One manager reported sacred bamboo seedlings as the first plants to emerge after prescribed fire in northern Florida (personal communication [33]), suggesting that some aspect of postfire conditions promotes sacred bamboo germination. See [Plant response to fire](#) for more information.

Seedling establishment and plant growth: As of this writing (2009) little information was available regarding favorable conditions for sacred bamboo seedling establishment and plant growth.

Establishment: Several sources report that seedlings are often located in the vicinity of mature plants [12,21,23] or former planting sites ([12,50], personal communications [29,33,64]). One flora notes that mature plants may be found far from areas of cultivation in the southeastern United States [23].

One manager reported sacred bamboo seedlings as the first plants to emerge after prescribed fire in northern Florida, suggesting the potential for sacred bamboo establishment in burned areas. It is not known if seedlings would persist in burned areas because managers killed them soon after emergence (personal communication [33]). See [Plant response to fire](#) for more information.

Growth: Sacred bamboo is described as a slow-growing plant [16], with one source suggesting it takes "years" to reach maturity (personal communication [49]). In northern Florida, the growth and structure of sacred bamboo populations varied at 3 upland forest and upland mixed forest sites, though reproductive output, quantified in terms of inflorescences and seedlings near mature plants, was similar [12].

Plant characteristics for wild populations of sacred bamboo plants >12 inches (30 cm) tall at 3 sites in northern Florida [12]	
Mean stem height (cm)*	91.6
Mean crown width (cm)*	79.4
Mean crown depth (cm)*	46.4

Mean number of stems/plant*	3.1
Mean number of leaves/plant*	5.6
Mean number of seedlings within 25 cm of plant	4.9
Mean number of inflorescences	1.1
*characteristic was significantly different between the 3 sites ($P < 0.05$)	

Some data suggest that light levels influence sacred bamboo growth. In wild populations in northern Florida, sacred bamboo plants produced wider and thinner leaves in shady sites compared to more open sites. Experiments with sacred bamboo seedlings suggest that high-light conditions (>50% light) limit growth and may cause photoinjury [12]. See [Successional status](#) for more information on this topic.

Vegetative regeneration: Sacred bamboo appears to have the capacity for vegetative regeneration, but the prevalence of this strategy is not well documented. Managers in both Florida (personal communication [49]) and Tennessee (personal communication [21]) observed that reproduction by seed was a much more common and likely form of reproduction than vegetative spread.

Several sources report that sacred bamboo is rhizomatous ([12,18,26], reviews by [39,45]), while 1 flora reports that rhizomes are absent [23]. Sacred bamboo populations in Tennessee did not appear to be rhizomatous, as plants did not appear to be growing in clonal patches and seedlings had no apparent underground connection to mature plants (personal communication [21]).

Several sources suggest that sacred bamboo may regenerate vegetatively by sprouting (review by [5]), particularly from the roots ([12,15], reviews by [50,65], personal communications [24,64]). Root sprouting may occur after control treatments (personal communications [24,64]) or top-kill from freezing temperatures [15,18]. Top-killed sacred bamboo sprouted from the base following winter, spring, and summer prescribed fire treatments in Florida (personal communication [33]) (See [Plant response to fire](#) for more information). One manager observed that sprouting may occur a year after damage (personal communication [49]).

In northern Florida, the accumulation of sand and litter around the base of sacred bamboo plants in a flood-prone area caused several plants to form adventitious roots. The author reported that the formation of such roots was not a generally recognized characteristic of sacred bamboo [12].

SITE CHARACTERISTICS:

General site characteristics: Sacred bamboo occupies several site types. It commonly occurs near human habitations ([20,23,26,50]), roads [19,47], or ruderal areas [14,60], and may spread from these locations into native plant communities (personal communication [33]).

Floras report sacred bamboo occupying woodlands [13,23,26,56], secondary woods [14], and sandy woods [17], as well as floodplains [14,23] or wet, disturbed hammocks [23,79]. See [Habitat types and plant communities](#) for specific descriptions of plant communities where sacred bamboo occurs.

Elevation: In the United States, sacred bamboo occurs from 0 to 2,200 feet (0-660 m) [23].

Soil: A review reports that sacred bamboo tolerates a wide range of soil characteristics but prefers moist, well-drained soil [5]. A manual to woody landscaping plants reports that sacred bamboo prefers moist, fertile soil [18]. Reports from Texas suggest that sacred bamboo prefers "reasonably rich" soil and does not thrive in sand (review by [65]), though one flora reports that it occupies sandy woods in north-central Texas [17]. Sites in northern Florida with high densities of sacred bamboo had calcareous, clay-rich, acidic sand, and/or fine sandy loam soils, with pH ranging from 4.5 to 8 [12].

Field trials in California demonstrated that sacred bamboo exhibits some degree of salt tolerance; sacred bamboo plants tolerated water with high salt concentrations when water was applied using drip irrigation, but application with a

sprinkler caused chlorosis and leaf loss [78].

Topography: In Florida, sacred bamboo frequently occurs around limestone outcroppings (personal communication [43]) or rocky outcrops (personal communication [3]). It also established on wet slopes and ravines in north and north-central Florida (personal communication [41]) and slope woodlands in central Texas [55].

Climate: At sites in northern Florida with high densities of sacred bamboo, mean annual temperature ranged from 67.1 °F to 71.1 °F (19.5 °C-21.7 °C), and mean annual rainfall ranged from 1,330 mm to 1,600 mm [12].

Experiments in New Zealand with sacred bamboo cultivars 'Pygmaea' and 'Fire Power' reported frost hardiness temperatures of 18 °F (-8 °C) and lethal temperatures of 7 °F (-14 °C) [61]. A review reports that sacred bamboo foliage tolerates temperatures as low as 1 °F (-17 °C) and stem loss does not occur until -11 °F (-24 °C). Drought in northern Florida may have caused sacred bamboo to abort inflorescences [12], and cold weather in Washington, DC, top-killed ornamental plants, though they later sprouted from roots [15]. Ornamental plants in Connecticut, Ohio, and Kentucky were considered "dieback" shrubs. One ornamental plant in Louisville, Kentucky was top-killed following temperatures as low as -24 °F (-31 °C) in January but sprouted and grew 3 feet (1 m) tall by September [18].

SUCCESSIONAL STATUS:

Successional stage and light preference: The few reports of sacred bamboo occurring in native plant communities suggest that it rarely occurs in early succession, as most observations are from mid- to late-successional plant communities. Sacred bamboo occurred in late-successional ravine communities in Tennessee (personal communication [21]) as well as undisturbed upland hardwood forests in northern Florida. It also occurred in disturbed upland hardwood and upland mixed forests in northern Florida [12], second-growth hammock forests on the Florida panhandle [25], and second-growth oak-hickory forest (personal communication [66]) and "secondary" mixed-hardwood forest (personal communication [24]) in Tennessee.

The prevalence of sacred bamboo in mid- and late-successional plant communities may be related to light tolerance. Sacred bamboo occurs in both high and low light conditions. Several sources report sacred bamboo as shade tolerant ([18,21], reviews by [5,39,50,62,65], personal communications [33,43]), occurring under forest canopies (reviews by [50,65], personal communication [43]). In eastern Tennessee near Knoxville, sacred bamboo usually occurred in rocky, shady woods. It was also found in shady alluvial forest in southeastern Louisiana (personal communication [21]). In Florida, sacred bamboo occurred in the understory of upland hardwood forest, slope forest, and bluff plant communities, and was not observed growing in full sun (personal communication [43]).

Though most reports of sacred bamboo describe it as occurring in shady areas, it may grow in full sun ([18], reviews by [39,62,65]), near forest edges (reviews by [5,50,65], personal communication [24]), or in open areas (personal communication [24]) like along fencerows (personal communication [21]).

To examine sacred bamboo's ability to tolerate open conditions and potentially establish in plant communities with high light levels, a series of growth experiments used various light levels to simulate light conditions in several Florida plant communities. Light levels ranged from 8% to 100%. Sacred bamboo plants were able to produce new leaf phenotypes to maximize light capture and photosynthetic rates in response to low-light conditions. Year-old plants acclimated to situations with 8% to 100% light, with photosynthetic capacity increasing as the amount of available light increased ($P \leq 0.05$). Year-old plants showed no sign of photoinjury. Seedlings flourished in 8% to 50% light but were unable to acclimate to full sun conditions and may have experienced photoinjury. The results of this experiment suggest that light may limit sacred bamboo seedling establishment and growth in open areas and prairies but not in most other Florida plant communities. Older plants may tolerate high light conditions. Because this study did not address light preferences or other conditions needed for successful germination, the ability of sacred bamboo to establish in native plant communities with different light conditions is not clear [12].

Disturbance: Sacred bamboo may establish in disturbed areas, including disturbed forests ([12,23,79], personal communication [66]), along roadsides [19,47], or in other ruderal areas [14,60]. It is not clear what disturbance processes or characteristics sacred bamboo may respond to.

Sacred bamboo tolerates flooding. Sacred bamboo may occupy floodplain ([12,14,23], reviews by [5,39], personal communications [3,29,42]), bottomland (personal communication [64]), or wetland (review by [1]) sites throughout its North American range, though it was not observed in sites with excessively waterlogged soils north of Tallahassee, Florida (personal communication [64]). Sacred bamboo densities are high in forests in northern Florida where flooding is a common disturbance [12]. One review reported that sacred bamboo withstood flooding for most of one growing season [73]. In California, a sacred bamboo plant survived 37 days of partial submersion to a maximum water depth of 6 inches (15 cm) in the growing season (Harris and others 1975 cited in [73]).

Successional role: Though sacred bamboo may dominate forest understories where it occurs (personal communication [40]) and impact native species ([55], personal communication [64]), it not clear whether or not it would alter successional pathways. In situations where sacred bamboo suppresses native species or prevents their establishment, it is possible that successional pathways may be altered. In some areas where it is established in northern Florida, sacred bamboo formed a dense, evergreen shrub layer in what was normally an open understory and altered light availability to other subcanopy plants. In temperate hardwood and broad-leaved evergreen forests, leaf area index increased and percent canopy openness decreased with the inclusion of sacred bamboo foliage in measurements. The author hypothesized that this alteration in light availability impacted the recruitment and regeneration of native understory species, though she did not study this topic specifically [12]. Also in Florida, one manager reported that much of sacred bamboo's impact on native vegetation appeared to be a preemption of available space and the subsequent prevention of recruitment of native species (personal communication [64]). In slope woodlands in central Texas, the foliage of sacred bamboo blocked sunlight from reaching the woodland floor, suppressing native plant species [55].

FIRE EFFECTS AND MANAGEMENT

SPECIES: *Nandina domestica*

- [FIRE EFFECTS](#)
- [FUELS AND FIRE REGIMES](#)
- [FIRE MANAGEMENT CONSIDERATIONS](#)

FIRE EFFECTS:

Immediate fire effect on plant: Only 1 observation of fire effects on sacred bamboo was available as of 2009. Fire likely top-kills sacred bamboo; in northern Florida, sacred bamboo was top-killed but eventually sprouted from the base following prescribed fire. Because sacred bamboo seedlings were the first plants to emerge following prescribed fire (personal communication [33]), some seeds likely survive fire (See [Plant response to fire](#)).

Postfire regeneration strategy [63]:

Tall shrub, [adventitious](#) buds and/or a sprouting [root crown](#)

Rhizomatous shrub, [rhizome](#) in soil

[Ground residual colonizer](#) (on site, initial community)

[Initial off-site colonizer](#) (off site, initial community)

[Secondary colonizer](#) (on- or off-site seed sources)

Fire adaptations and plant response to fire:

- [Fire adaptations](#)
- [Plant response to fire](#)

Fire adaptations: As of 2009, there was no published information regarding sacred bamboo adaptations to fire. The information presented here is inferred from reported botanical traits and the unpublished postfire observations from

one manager in Florida.

Sacred bamboo's ability to sprout (review by [5]), particularly from roots ([12,15], reviews by [50,65], personal communications [24,64]), suggests that top-killed sacred bamboo plants may regenerate vegetatively following fire. Top-killed sacred bamboo sprouted from the base following prescribed fire in northern Florida (personal communication [33]). Sacred bamboo rhizomes ([12,18,26], reviews by [39,45]) may also sprout after fire, though this response has not been documented. Sacred bamboo exhibits new leaf and stem growth in both the spring and fall [12], which may facilitate a quick response to top-kill after fire in any season. New growth may be substantial; one ornamental plant in Kentucky sprouted and grew 3 feet (1 m) within 9 months of top-kill from freezing [18]. Though it is unknown how deep sacred bamboo roots penetrate in the soil, its large root mass ([26], personal communications [44,59]) and substantial taproot [34] likely improve its chances of surviving and sprouting following fire.

Though the mechanism is not clear (e.g., depth in soil, seed characteristics), at least some sacred bamboo seeds present in the soil seed bank may survive and germinate after fire; sacred bamboo seedlings were the first plants to emerge following prescribed fire treatments in northern Florida (personal communication [33]). Because sacred bamboo seeds may remain dormant for >1 year ([12], review by [39]), germination may occur from soil-stored seed for at least a year after fire, although this response has not been documented. Sacred bamboo seeds could be carried long distances by birds ([52], reviews by [5,34,39], personal communication [43]) or mammals (reviews by [5,39], personal communication [43]) and deposited in burned areas following fire.

It is not clear whether the high light conditions existing after fire would favor the establishment of sacred bamboo. Sacred bamboo often inhabits shaded areas ([18,21], reviews by [5,39,50,62,65], personal communications [33,43]), and light experiments demonstrated that sacred bamboo seedlings experienced limited growth and likely photoinjury when exposed to >50% light conditions [12]. However, some reports indicate that sacred bamboo can grow in full sun ([18], reviews by [39,62,65]), near forest edges (reviews by [5,50,65], personal communication [24]), or in open areas (personal communication [24]). See [Successional stage and light preference](#) for more information on this topic.

Plant response to fire: As of 2009, there is only 1 observation of sacred bamboo response to fire. At Three Rivers State Park in the north-central Florida panhandle, managers have used prescribed fire in winter, spring, and summer in an attempt to control sacred bamboo. Following fire in all seasons, sacred bamboo was top-killed but eventually sprouted from the base. The on-site seeds of sacred bamboo germinated after fire; sacred bamboo seedlings were the first plants to emerge following fire treatments. It is not clear whether seedlings would persist following fire, as seedlings were killed by managers soon after emergence. Overall, regular burning appeared to reduce sacred bamboo reproduction and sprouting; few sacred bamboo plants were found in one area that was burned 3 times between 2005 and 2009 (personal communication [33]).

FUELS AND FIRE REGIMES:

Fuels: As of this writing (2009) fuel characteristics of sacred bamboo have not been documented. Fuel characteristics of plant communities could potentially be altered in areas where sacred bamboo establishes in densities and/or growth patterns differing from those of native vegetation, such as where it develops in dense stands ([12,55], review by [39], personal communications [29,33]) or dominates the understory (personal communication [40]). In northern Florida, sacred bamboo was capable of forming a dense, evergreen shrub layer in what was normally an open understory, increasing leaf area index and decreasing percent canopy openness [12].

Fire regimes: It is not known what type of fire regimes sacred bamboo is best adapted to. Several managers from Florida reported that sacred bamboo occurred in plant communities where fire is infrequent and not a major factor affecting plant community development (personal communications [42,43,49,64]). The [Fire Regime Table](#) suggests that plant communities where sacred bamboo establishes tend to experience surface or low-severity fire, though fire-return intervals vary among plant communities. The impacts of sacred bamboo on these fire regimes is unknown. See the [Fire Regime Table](#) for further information on fire regimes of vegetation communities in which sacred bamboo may occur.

FIRE MANAGEMENT CONSIDERATIONS:

Preventing postfire establishment and spread: The little information available regarding sacred bamboo and fire suggests that postfire establishment and spread is likely in areas with existing populations of sacred bamboo, either

via vegetative regeneration or by seed. It is likely that top-killed sacred bamboo will sprout following fire (personal communication [33]), though managers should be aware that sprouting after damage may not occur for at least a year (personal communication [49]). Sacred bamboo seedlings from on-site sources may emerge soon after fire (personal communication [33]), though it may be possible for on-site seeds to germinate up to a year following fire because seeds exhibit dormancy ([12], review by [39]). Observations of sacred bamboo taking 18 months to several years to mature ([12], review by [65], personal communication [49]) suggest that managers may have time to eradicate establishing plants prior to new seed production.

It is possible that sacred bamboo may establish in new areas after fire; sacred bamboo seeds may be carried long distances from off-site sources by birds ([52], reviews by [5,34,39], personal communication [43]) or mammals (reviews by [5,39], personal communication [43]).

Because of the potential of delayed response, careful monitoring and follow-up is suggested to reduce the likelihood of sacred bamboo establishment and spread after fire. Preventing invasive plants from establishing in weed-free burned areas is the most effective and least costly management method. This may be accomplished through early detection and eradication, careful monitoring and follow-up, and limiting dispersal of invasive plant seed into burned areas. 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: [2,6,28,69].

Use of prescribed fire as a control agent: Because there is no published information (2009) regarding the use of fire to control sacred bamboo, the suggestions made in this section should be considered speculative. Observations from northern Florida suggest that repeated fire treatments and follow-up removal of seedlings may be effective in controlling sacred bamboo populations; few sacred bamboo plants were found in an area where surface growth was burned 3 times between 2005 and 2009 and seedlings were killed by managers (personal communication [33]).

It seems likely that the use of prescribed fire without follow-up removal of seedlings would promote sacred bamboo populations, as conditions following prescribed fire seem to favor the emergence of sacred bamboo seedlings (personal communication [33]). However, it is not clear how long seedlings would persist in open conditions; light experiments demonstrated that sacred bamboo seedlings experienced limited growth and potential photoinjury when exposed to >50% light conditions [12]. This topic warrants further study.

MANAGEMENT CONSIDERATIONS

- [FEDERAL LEGAL STATUS](#)
- [OTHER STATUS](#)
- [IMPORTANCE TO WILDLIFE AND LIVESTOCK](#)
- [OTHER USES](#)
- [IMPACTS AND CONTROL](#)

FEDERAL LEGAL STATUS:

None

OTHER STATUS:

Information on state-level noxious weed status of plants in the United States is available at [Plants Database](#).

IMPORTANCE TO WILDLIFE AND LIVESTOCK:

Though sacred bamboo seeds are dispersed by birds and mammals, there is little evidence to suggest that it is an important species for wildlife in North America. Sacred bamboo is poisonous to livestock and other domestic animals.

Palatability and/or nutritional value: Sacred bamboo fruits are edible to birds ([52], reviews by [5,34,39], personal communication [43]) and mammals (reviews by [5,39], personal communication [43]). Fruits contain 42% water and 5% protein, provide 4.42 kcal/g, and have a low pulp to seed ratio [48]. Sacred bamboo leaves collected in Arizona had a protein content of 9.9% [11].

Sacred bamboo foliage and fruit are poisonous to some animals. Sacred bamboo foliage contains cyanogenic glycosides [8,18], which are poisonous to all animals, particularly ruminants [9]. Small amounts of foliage are hazardous to cattle [8], and animals may become comatose 5 to 10 minutes after the first signs of poisoning appear [9]. A puppy had a seizure after eating sacred bamboo foliage [18]. Sacred bamboo berries are toxic to cats and some grazing animals (review by [65]).

Cover value: No information is available on this topic (2009).

OTHER USES:

Sacred bamboo is a popular ornamental plant [4,62,77]. It has been cultivated for the medicinal properties of its leaves and berries [22]. The aromatic twigs may be used as toothpicks or toothbrushes [62]. Preparation of the whole plant is used as an herbal pesticide to control aphids in China [80].

IMPACTS AND CONTROL:

Impacts: Several sources report that sacred bamboo may replace native species ([12,55], reviews by [34,39,45,65], personal communications [3,43,59,64]), though some managers report that native plant exclusion has not occurred as of 2009 ([21], personal communications [33,54,59,66]).

Sacred bamboo may impact several species of concern, particularly in Florida. In upland mixed forest plant communities at Florida Caverns State Park, sacred bamboo poses a threat to species listed as endangered in Florida, including spoonshape Barbara's buttons (*Marshallia obovata*), Flyr's nemesis (*Brickellia cordifolia*), cream ticktrefoil (*Desmodium ochroleucum*), and spiked crested coralroot (*Hexalectris spicata*). In calcareous bluff plant communities in Florida, sacred bamboo may potentially exclude the state-endangered red columbine (*Aquilegia canadensis*), mayapple (*Podophyllum peltatum*), eastern false rue anemone (*Enemion biternatum*), Allegheny-spurge (*Pachysandra procumbens*), and the rare oakleaf hydrangea (*Hydrangea quercifolia*) (personal communication [3]). In Tom Brown Park, Florida, sacred bamboo may prevent regeneration and growth of the state-endangered October lady's tresses (*Spiranthes ovalis* var. *ovalis*) orchid, which prefers open understory conditions [12]. Sacred bamboo also occurs around limestone outcroppings in Florida, where it competes with and may shade out rare natives such as the Marianna columbine (*A. canadensis* var. *australis*) and eastern false rue anemone (personal communication [43]). In Tennessee, sacred bamboo occurred in a late-successional ravine plant community with the federally threatened

largeflower skullcap (*Scutellaria montana*), though as of 2009, sacred bamboo was not established to an extent that it was excluding other understory plants (personal communication [21]).

Control: In all cases where invasive species are targeted for control, no matter what method is employed, the potential for other invasive species to fill their void must be considered [7]. 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 [46].

Sacred bamboo exhibits several characteristics that may complicate control efforts. A manual to woody landscaping plants reports that "once established they are forever, possibly one of the most durable broadleaf evergreens" [18]. Extensive root systems (review by [65], personal communications [24,44,64]) may make removal difficult, particularly as sacred bamboo may sprout following damage or treatment ([15,18], review by [5], personal communications [24,49,59]), with sprouting potentially delayed as long as a year (personal communication [49]). Sacred bamboo also produces abundant seed crops (personal communication [41]), and seeds may remain on plants for several months (review by [45]) or remain dormant in the soil for at least a year ([12], review by [39]). Seedlings may also be abundant (personal communication [33]). Individual plants may be difficult to locate amidst other vegetation or topographical features (personal communications [3,33,43,64]). Consequently, some managers recommend that search efforts take place in winter, when the evergreen leaves and bright berries of sacred bamboo are readily visible (personal communications [3,43]).

One manager suggested that control measures are temporary and may even promote sacred bamboo, as sprouting from extensive root systems may allow it to "rebound" more quickly than surrounding native vegetation (personal communication [44]). Managers suggest that revisitation and follow-up treatments are often necessary to effectively control sacred bamboo (personal communications [24,33,41,49,59,64]).

Fire: For information on the use of prescribed fire to control this species, see [Fire Management Considerations](#).

Prevention: One of the easiest ways to prevent future establishment and spread of sacred bamboo is to avoid planting it. Sacred bamboo is 1 of the 3 most commercially valuable plants to nursery operators in Florida [4]. In 2004, the maximum annual sales of sacred bamboo reported by a single grower was \$30,000, while the mean annual sales for 141 Florida nurseries was \$3,200 [77]. Sacred bamboo cultivars that do not produce seed (review by [45]), viable seed [12], or bird-dispersed fruit (review by [39]) may be suitable alternatives for ornamental growers. In Texas, suggested alternatives to sacred bamboo include Texas barometer bush (*Leucophyllum frutescens*), wild crapemyrtle (*Malpighia glabra*), autumn sage (*Salvia greggi*), and doctorbush (*Plumbago scandens*) (review by [65]).

It is commonly argued that the most cost-efficient and effective method of managing invasive species is to prevent their establishment and spread by maintaining "healthy" natural communities [46,58] (e.g., avoid road building in wildlands [68]) and by monitoring several times each year [32]). Managing to maintain the integrity of the native plant community and mitigate the factors enhancing ecosystem invasibility is likely to be more effective than managing solely to control the invader [31].

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 [69]. See the [Guide to noxious weed prevention practices](#) [69] for specific guidelines in preventing the spread of weed seeds and propagules under different management conditions.

Cultural control: No information is available on this topic (2009).

Physical or mechanical control: Several sources suggest hand-pulling may be effective for controlling sacred bamboo seedlings ([12], review by [34], personal communication [54]) or small populations (review by [45]). In northern Florida, there was no sign of growth or sprouting 360 days after seedlings were hand-pulled [12]. At Three Rivers State Park in the north-central Florida panhandle, hand-pulling was considered the best method for controlling sacred bamboo (personal communication [33]). Digging out large plants may be difficult because of deep taproots (review by [34]), and physical control may be hampered by the potential sprouting of root fragments (reviews by

[45,65]). Frequent mowing may be effective at controlling sacred bamboo, though plants may continue to spread rhizomatously (review by [45]).

Because sacred bamboo produces abundant seed crops (personal communication [41]) and seeds remain on the plant for several months, care must be exercised to prevent seed spread and dispersal during the removal process (review by [45]). Ideally, physical or mechanical control should occur before seeds are produced. To prevent spread, seeds should be collected and destroyed (reviews by [38,65]).

Biological control: Biological control of invasive species has a long history that indicates many factors must be considered before using biological controls. Refer to these sources: [71,76] and the [Weed control methods handbook](#) [67] for background information and important considerations for developing and implementing biological control programs.

As of this writing (2009) there were no biological control programs identified for the control of sacred bamboo. Sacred bamboo plants are susceptible to scale and mites. Leaf spot diseases often cause lower leaves to drop in humid areas. Such diseases are most severe on plants grown in partial shade where foliage is consistently damp (review by [65]).

Chemical control: Herbicides are effective in gaining initial control of a new invasion or a severe infestation, but they are rarely a complete or long-term solution to weed management [10]. See the [Weed control methods handbook](#) [67] for considerations on the use of herbicides in natural areas and detailed information on specific chemicals.

Several sources report that sacred bamboo may be controlled using herbicides ([12], reviews by [5,38], personal communications [3,24,29,41,43,49,59]), though direct application may be time consuming and labor intensive (personal communication [43]). Repeated applications may be necessary in areas with high density (review by [65]) and to prevent sprouting following treatment (personal communications [24,49,59,64]). At Three Rivers State Park, Florida, 1 manager noted that while sacred bamboo stems died back as a result of herbicide application, the root systems were large from many years of past growth and often sent up new stems in the growing season following treatment (personal communication [64]). One year after basal bark herbicide application to sacred bamboo in northern Florida, there was no evidence of sprouting or production of new rhizomes [12].

Several sources recommend herbicide application to cut stems of sacred bamboo (reviews by [34,65], personal communications [24,29,33]), though follow-up treatment may be necessary due to root sprouting following control efforts (personal communication [24]).

Integrated management: No information is available on this topic.

APPENDIX: FIRE REGIME TABLE

SPECIES: *Nandina domestica*

This Fire Regime Table summarizes characteristics of fire regimes for vegetation communities in which sacred bamboo may occur based on descriptions in available literature and from local observations of managers and botanists. Follow the links in the table to documents that provide more detailed information on these fire regimes. Because there is so little information available describing the plant communities in which sacred bamboo occurs, it is likely that sacred bamboo occurs in vegetation communities not presented here. Refer to the complete [FEIS Fire Regime Table](#) for fire regime information for other plant communities.

Fire regime information on vegetation communities in which sacred bamboo may occur. This information is taken from the LANDFIRE Rapid Assessment Vegetation Models [37], 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
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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.

South-central US		Southern Appalachians		Southeast	
South-central US					
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 Forested					
Southern floodplain	Replacement	42%	140		
	Surface or low	58%	100		
Southern floodplain (rare fire)	Replacement	42%	≥1,000		
	Surface or low	58%	714		
Southern Appalachians					
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					
Bottomland hardwood forest	Replacement	25%	435	200	≥1,000
	Mixed	24%	455	150	500
	Surface or low	51%	210	50	250
Mixed mesophytic hardwood	Replacement	11%	665		
	Mixed	10%	715		
	Surface or low	79%	90		
Appalachian oak-hickory-pine	Replacement	3%	180	30	500
	Mixed	8%	65	15	150
	Surface or low	89%	6	3	10
Oak (eastern dry-xeric)	Replacement	6%	128	50	100
	Mixed	16%	50	20	30
	Surface or low	78%	10	1	10
Southeast					
<ul style="list-style-type: none"> • 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 Woodland					
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		
Maritime forest	Replacement	18%	40		500
	Mixed	2%	310	100	500
	Surface or low	80%	9	3	50
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		
<p>*Fire Severities—</p> <p>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.</p> <p>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.</p> <p>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 [30,36].</p>					

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