

Family: *Berberidaceae*

Taxon: *Nandina domestica*

Synonym: *Nandina domestica* var. *linearifolia* C.Y. Wu **Common Name:** Heavenly bamboo
Nandina
Sacred bamboo
Southern heaven bamboo

Questionnaire :	current 20090513	Assessor:	Chuck Chimera	Designation: H(HPWRA)
Status:	Assessor Approved	Data Entry Person:	Chuck Chimera	WRA Score 9
101	Is the species highly domesticated?		y=-3, n=0	y
102	Has the species become naturalized where grown?		y=1, n=-1	y
103	Does the species have weedy races?		y=1, n=-1	y
201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"		(0-low; 1-intermediate; 2-high) (See Appendix 2)	Low
202	Quality of climate match data		(0-low; 1-intermediate; 2-high) (See Appendix 2)	Intermediate
203	Broad climate suitability (environmental versatility)		y=1, n=0	y
204	Native or naturalized in regions with tropical or subtropical climates		y=1, n=0	y
205	Does the species have a history of repeated introductions outside its natural range?		y=-2, ?=-1, n=0	y
301	Naturalized beyond native range		y = 1*multiplier (see Appendix 2), n= question 205	y
302	Garden/amenity/disturbance weed		n=0, y = 1*multiplier (see Appendix 2)	n
303	Agricultural/forestry/horticultural weed		n=0, y = 2*multiplier (see Appendix 2)	n
304	Environmental weed		n=0, y = 2*multiplier (see Appendix 2)	y
305	Congeneric weed		n=0, y = 1*multiplier (see Appendix 2)	n
401	Produces spines, thorns or burrs		y=1, n=0	n
402	Allelopathic		y=1, n=0	n
403	Parasitic		y=1, n=0	n
404	Unpalatable to grazing animals		y=1, n=-1	y
405	Toxic to animals		y=1, n=0	y
406	Host for recognized pests and pathogens		y=1, n=0	n
407	Causes allergies or is otherwise toxic to humans		y=1, n=0	
408	Creates a fire hazard in natural ecosystems		y=1, n=0	n
409	Is a shade tolerant plant at some stage of its life cycle		y=1, n=0	y
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)		y=1, n=0	y

411	Climbing or smothering growth habit	y=1, n=0	n
412	Forms dense thickets	y=1, n=0	y
501	Aquatic	y=5, n=0	n
502	Grass	y=1, n=0	n
503	Nitrogen fixing woody plant	y=1, n=0	n
504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	y=1, n=0	n
601	Evidence of substantial reproductive failure in native habitat	y=1, n=0	n
602	Produces viable seed	y=1, n=-1	y
603	Hybridizes naturally	y=1, n=-1	n
604	Self-compatible or apomictic	y=1, n=-1	
605	Requires specialist pollinators	y=-1, n=0	
606	Reproduction by vegetative fragmentation	y=1, n=-1	y
607	Minimum generative time (years)	1 year = 1, 2 or 3 years = 0, 4+ years = -1	2
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y=1, n=-1	n
702	Propagules dispersed intentionally by people	y=1, n=-1	y
703	Propagules likely to disperse as a produce contaminant	y=1, n=-1	n
704	Propagules adapted to wind dispersal	y=1, n=-1	n
705	Propagules water dispersed	y=1, n=-1	
706	Propagules bird dispersed	y=1, n=-1	y
707	Propagules dispersed by other animals (externally)	y=1, n=-1	n
708	Propagules survive passage through the gut	y=1, n=-1	y
801	Prolific seed production (>1000/m2)	y=1, n=-1	
802	Evidence that a persistent propagule bank is formed (>1 yr)	y=1, n=-1	
803	Well controlled by herbicides	y=-1, n=1	y
804	Tolerates, or benefits from, mutilation, cultivation, or fire	y=1, n=-1	y
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	y=-1, n=1	

Designation: H(HPWRA)

WRA Score 9

Supporting Data:

101	2005. Staples, G.W./Herbst, D.R.. A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places. Bishop Museum Press, Honolulu, HI	[Is the species highly domesticated? Yes] "Although it has long been cultivated and esteemed throughout its range, notably by the Chinese, the Japanese in particular have extensively selected and developed heavenly-bamboo in cultivation, and more than 50 cultivars have been recognized, only a few of which are grown outside of Japan."
101	2006. Anderson, N.O./Galatowitsch, S.M./Gomez, N.. Selection strategies to reduce invasive potential in introduced plants. <i>Euphytica</i> . 148: 203–216.	[Is the species highly domesticated? Yes] "Nandina domestica cultivars differed in flowering and fruiting ability in two cultivated sites (Knox et al., 2004), although cultivar rankings (stability) were relatively constant across sites for all genotypes except one (Knox et al., 2004)."
101	2006. Knox, G.W./Wilson, S.B.. Evaluating North and South Florida Landscape Performance and Fruiting of Ten Cultivars and a Wild-type Selection of <i>Nandina domestica</i> , a Potentially Invasive Shrub. <i>Journal of Environmental Horticulture</i> . 24(3): 137–142.	[Is the species highly domesticated? Yes, for certain cultivars] "A wild-type selection of heavenly bamboo (<i>Nandina domestica</i>) and ten cultivars were evaluated for plant performance, growth, flowering, and fruiting in north and south Florida. Onset of flowering generally began by March and April in south Florida and 4 to 8 weeks later in north Florida. Fruit was first noted 8 to 16 weeks after most selections began flowering. Landscape performance and fruit production varied widely among taxa and locations. The dwarf selections 'Filamentosa' and 'Firepower' failed to flower or fruit in either location; while the medium sized selection, 'Moon Bay', did not flower or fruit in south Florida, and the medium-sized selection, 'Gulf Stream', flowered but did not fruit in south Florida. Large-sized selections produced more fruit than did dwarf and medium sized cultivars. Greater plant survival with generally heavier fruiting was observed in north Florida than in south Florida. In north and south Florida, 'Monum' and 'Compacta' produced more fruit than did the wild-type selection. Seed viability was fairly consistent among cultivars, ranging from 73 to 86%."
101	2009. Trueblood, C.E.. An Invasive Species Assessment System for the North Carolina Horticultural Industry. MSc Thesis. North Carolina State University, Raleigh, NC	[Is the species highly domesticated? Yes] "Cultivars, including Nana, Harbour Dwarf, and Firepower, have been developed that produce little or no seed (Langeland and Craddock Burks 2008)."
102	2010. Murray, B.R./Phillips, M.L.. Investment in seed dispersal structures is linked to invasiveness in exotic plant species of south-eastern Australia. <i>Biological Invasions</i> . 12: 2265–2275.	[Has the species become naturalized where grown? Yes] "Table 1 The dataset of naturalized exotic plant species of Royal National Park (south-eastern Australia)..." [<i>Nandina domestica</i> listed as naturalized]
103	2003. Weber, E.. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	[Does the species have weedy races? Yes] "The dense foliage of this shrub shades out native plants and prevents their regeneration. It forms extensive and dense stands displacing native vegetation. Populations of two rare plants are threatened in Florida by this invader."
201	1987. Clay, H.F./Hubbard, J.C.. The Hawaii Garden: Tropical Shrubs. University of Hawaii Press, Honolulu, HI	[Species suited to tropical or subtropical climate(s) -? 0-low] "Seeds must be refrigerated before they will germinate,,,"
201	2005. Staples, G.W./Herbst, D.R.. A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places. Bishop Museum Press, Honolulu, HI	[Species suited to tropical or subtropical climate(s) -? 0-low] " <i>Nandina domestica</i> has a wide distribution from India across eastern Asia to Japan, where it is reported to be native to forested areas in the southern part of the islands... Seed is slow to germinate and requires a period of dry, cold storage (three to four months at 40°F) for the rudimentary embryo to undergo further development, or "ripening." [For the special cases of a temperate species whose seeds have been reported to require cold-stratification for germination, the answer to this question is 0(low) and the answer to question 2.02 is 1 (intermediate) regardless of knowledge of the species native range.]
202	2005. Staples, G.W./Herbst, D.R.. A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places. Bishop Museum Press, Honolulu, HI	[Quality of climate match data? 1-intermediate] " <i>Nandina domestica</i> has a wide distribution from India across eastern Asia to Japan, where it is reported to be native to forested areas in the southern part of the islands... Seed is slow to germinate and requires a period of dry, cold storage (three to four months at 40°F) for the rudimentary embryo to undergo further development, or "ripening." [For the special cases of a temperate species whose seeds have been reported to require cold-stratification for germination, the answer to this question is 0(low) and the answer to question 2.02 is 1 (intermediate) regardless of knowledge of the species native range.]
203	1987. Clay, H.F./Hubbard, J.C.. The Hawaii Garden: Tropical Shrubs. University of Hawaii Press, Honolulu, HI	[Broad climate suitability (environmental versatility)? Yes] "Very adaptable; although originally from a colder, temperate climate, the plant will grow almost anywhere in Hawaii, even at the beach if protected from salt winds."

204	2001. Langeland, K.A./Stocker, R.K.. Control of Non-native Plants in Natural Areas of Florida. Institute of Food & Agricultural Sciences, University of Florida, Gainesville, FL http://mrec.ifas.ufl.edu/ldspmgmt/Ldsp%20Turf%20Mgmt/PDFfiles/WG20900.pdf	[Native or naturalized in regions with tropical or subtropical climates? Yes] "Naturalized in Gadsden, Jackson, Leon, Wakulla, and perhaps other Counties." [marginally subtropical at approximately 30° North latitude, Florida]
205	2000. Whistler, W.A.. Tropical Ornamentals: A Guide. Timber Press, Portland, OR	[Does the species have a history of repeated introductions outside its natural range? Yes] "...widely cultivated in warm regions for its attractive foliage and red fruit."
301	1973. Clark, R.C./Powell, Jr., R.W./Childress, Jr., C.G.. Vascular Plants in Spartanburg County, South Carolina, New to the State, the Carolinas or the Southeastern United States. <i>Castanea</i> . 38(3): 297-302.	[Naturalized beyond native range? Escaped] "Nandina domestica Thunberg. Native to China and Japan, escaped in our area to mesic woodlands. Clark 19,936 with Powell & Childress, 7 October 1970."
301	2003. Judd, W.S.. New and Noteworthy Collections from Florida. <i>Castanea</i> . 68(1): 81-83.	[Naturalized beyond native range? Yes] "Nandina domestica Thunb. (BERBERIDACEAE) Alachua County: Gainesville, University of Florida campus; "Golf Course Woods "between U.F. golf course and 34th St., W. S. Judd 8019 (FLAS); a new county record, and the first record of the species in Florida outside of the panhandle. An occasional shrub, occurring in several campus natural areas. The species shows invasive potential, and also occurs at Alfred A. Ring Park in Gainesville."
301	2004. Vidra, R.L.. Implications of Exotic Species Invasion for Restoration of Urban Riparian Forests. PhD Dissertation. North Carolina State University, Raleigh. NC	[Naturalized beyond native range? Yes] "Propagules of some invasive exotic species are widespread in urban landscapes. In North Carolina, for example, the water- and wind-dispersed <i>Microstegium vimineum</i> is found in almost all riparian zones and is quickly becoming a noxious weed of playing fields, lawns, and adjacent forests (Barden 1987, Miller 2003). <i>Wisteria</i> spp., and <i>Nandina domestica</i> that have recently become invasive and are beginning to spread outside of their initial planting area. Thus, the vegetative spreading and animal; dispersal of ornamental exotic propagules from the adjacent landscapes into nearby riparian buffers could be substantial."
301	2005. Wagner, W.L./Herbst, D.R./Lorence, D.H.. Flora of the Hawaiian Islands website. Smithsonian Institution, Washington, D.C. http://botany.si.edu/pacificislandbiodiversity/hawaiianflora/index.htm	[Naturalized beyond native range? No evidence from Hawaiian Islands]
301	2006. Howell, C.J./Sawyer, J.W.D.. New Zealand naturalised vascular plant checklist. New Zealand Plant Conservation Network, Wellington, NZ www.nzpcn.org.nz	[Naturalized beyond native range? Casual] "Naturalised plant status...Casual" [Casual is the name given to taxa that are: passively regenerating only in the immediate vicinity of the cultivated parent plant, or more widespread but only known as isolated or few individuals; garden escapes persisting only 2–3 years; or garden discards persisting vegetatively but not spreading sexually or asexually]
301	2008. Foxcroft, L.C./Richardson, D.M./Wilson, J.R.U.. Ornamental Plants as Invasive Aliens: Problems and Solutions in Kruger National Park, South Africa. <i>Environmental Management</i> . 41: 32–51.	[Naturalized beyond native range? Yes] "Table 2 Ornamental alien plant species recorded per camp in the Kruger National Park, indicating the number of camps in which each species has been recorded, as well as mode of introduction... <i>Nandina domestica</i> ...Evidence of naturalization? Yes"
301	2009. Trueblood, C.E.. An Invasive Species Assessment System for the North Carolina Horticultural Industry. MSc Thesis. North Carolina State University, Raleigh, NC	[Naturalized beyond native range? Yes] " <i>Nandina domestica</i> (<i>Nandina</i> , Heavenly bamboo) is moderately weedy in North Carolina and may be recommended for horticultural use with specific guidance by the North Carolina Nursery and Landscape Association. <i>Nandina</i> is increasingly escaping and naturalizing in North Carolina The ecological impacts of <i>N. domestica</i> are largely unknown, but dense thickets of this species may shade out native herbs and displace native vegetation. There is potential for the additional invasion of <i>Nandina</i> to natural areas due to the high potential for natural dispersal from ornamental plantings. The difficulty of managing <i>Nandina</i> is moderate considering the availability of control methods, but management may be costly considering the time and labor required to effectively treat stands of this species. <i>Nandina domestica</i> has extremely high economic value to the nursery industry."
301	2010. Murray, B.R./Phillips, M.L.. Investment in seed dispersal structures is linked to invasiveness in exotic plant species of south-eastern Australia. <i>Biological Invasions</i> . 12: 2265–2275.	[Naturalized beyond native range? Yes] "Table 1 The dataset of naturalized exotic plant species of Royal National Park (south-eastern Australia)..." [<i>Nandina domestica</i> listed as naturalized]
302	2003. Weber, E.. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	[Garden/amenity/disturbance weed? No] No evidence

303	2003. Weber, E.. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	[Agricultural/forestry/horticultural weed? No] No evidence
304	2003. Weber, E.. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	[Environmental weed? Yes] "The dense foliage of this shrub shades out native plants and prevents their regeneration. It forms extensive and dense stands displacing native vegetation. Populations of two rare plants are threatened in Florida by this invader."
304	2006. Knox, G.W./Wilson, S.B.. Evaluating North and South Florida Landscape Performance and Fruiting of Ten Cultivars and a Wild-type Selection of <i>Nandina domestica</i> , a Potentially Invasive Shrub. <i>Journal of Environmental Horticulture</i> . 24(3): 137-142.	[Environmental weed? Yes] "Native to forest understories of central China and Japan and west to India, and introduced to the United States before 1804 (16), the species has escaped cultivation in nine states in the southeastern U.S. (27), including Florida (five counties) (33). The Florida Exotic Pest Plant Council (FLEPPC) lists heavenly bamboo as a Category I invasive species because it is ecologically damaging to natural areas (9). The IFAS Assessment documented self sustaining and expanding populations of heavenly bamboo in natural plant communities of north and central Florida (10) where it is altering the light environment (5), and displacing native vegetation (16). Consequently, it is not recommended for planting in north Florida (area annually receiving 420 or more chill units) and central Florida (area receiving more than 110 but fewer than 420 chill units), and the IFAS Assessment recommends caution if planting in south Florida (receiving 110 or fewer chill units) (10)."
304	2009. Trueblood, C.E.. An Invasive Species Assessment System for the North Carolina Horticultural Industry. MSc Thesis. North Carolina State University, Raleigh, NC	[Environmental weed? Yes] "Displaces native species and disrupts plant communities (USDA Forest Service 2006). Forms dense thickets that displaces native vegetation (UF/IFAS 2008). Actively disrupts plant communities (Scheper 2008)."
305	2005. Staples, G.W./Herbst, D.R.. A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places. Bishop Museum Press, Honolulu, HI	[Congeneric weed? No] "The single species of <i>Nandina</i> , now widespread from India to Japan, was perhaps originally native to central China."
401	2005. Staples, G.W./Herbst, D.R.. A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places. Bishop Museum Press, Honolulu, HI	[Produces spines, thorns or burrs? No] "Evergreen shrub 4-10 inches tall, stems erect, canelike, 0.5-1 inches in diameter, usually unbranched. Leaves alternate, 2x- or 3x-odd pinnately compound, 12-24 inches long; leaflets elliptic-lanceolate, 1.25-2.5 inches long, upper side deep green, underside paler, ±leathery, margins entire, apex long-tapering."
402	2003. Weber, E.. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	[Allelopathic? No] No evidence
402	2009. Stone, K.R.. <i>Nandina domestica</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [2011, May 10]	[Allelopathic? No] No evidence
402	2009. Trueblood, C.E.. An Invasive Species Assessment System for the North Carolina Horticultural Industry. MSc Thesis. North Carolina State University, Raleigh, NC	[Allelopathic? No] No evidence
403	2005. Staples, G.W./Herbst, D.R.. A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places. Bishop Museum Press, Honolulu, HI	"Evergreen shrub 4-10 inches tall, stems erect, canelike, 0.5-1 inches in diameter, usually unbranched." [Berberidaceae]
404	2009. Stone, K.R.. <i>Nandina domestica</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [2011, May 10]	[Unpalatable to grazing animals? Probably yes] "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]." [chemical compounds likely deter browsing]
404	2010. Oregon Department of Fish and Wildlife. Wildlife Division - Living with Deer and Elk- Deer Resistant Plants. http://www.dfw.state.or.us/wildlife/living_with/deer_resistant_plants.asp	[Unpalatable to grazing animals? Probably yes] "Deer Resistant Plants" [List includes <i>Nandina domestica</i>]

405	2009. Stone, K.R.. <i>Nandina domestica</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [2011, May 10]	[Toxic to animals? Yes] "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])."
405	2010. Woldemeskel, M./Styer, E.L.. Feeding Behavior-Related Toxicity due to <i>Nandina domestica</i> in Cedar Waxwings (<i>Bombycilla cedrorum</i>). <i>Veterinary Medicine International</i> . doi:10.4061/2010/818159: 1-4.	[Toxic to animals? Yes] "Dozens of Cedar Waxwings were found dead in Thomas County, Georgia, USA, in April 2009. Five of these were examined grossly and microscopically. Grossly, all the examined birds had pulmonary, mediastinal, and tracheal hemorrhages. Microscopically, several tissues and organs were diffusely congested and hemorrhagic. Congestion and hemorrhage were marked in the lungs. Intact and partly digested berries of <i>Nandina domestica</i> Thunb. were the only ingesta found in the gastrointestinal tract of these birds. Due to their voracious feeding behavior, the birds had eaten toxic doses of <i>N. domestica</i> berries. <i>N. domestica</i> contains cyanide and is one of the few berries readily available at this time of the year in the region. The gross and microscopic findings are consistent with lesions associated with cyanide toxicity. This paper for the first time documents toxicity associated with <i>N. domestica</i> in Cedar Waxwings...The berries of <i>N. domestica</i> are beloved by other birds such as robins and mockingbirds [6], indicating the potential toxicity to these birds if toxic doses are consumed during feed unavailability."
406	2005. Staples, G.W./Herbst, D.R.. <i>A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places</i> . Bishop Museum Press, Honolulu, HI	[Host for recognized pests and pathogens? No] "Few insects or diseases bother heavenly-bamboo."
407	2005. Staples, G.W./Herbst, D.R.. <i>A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places</i> . Bishop Museum Press, Honolulu, HI	[Causes allergies or is otherwise toxic to humans? Potentially] "All parts of the plant are used medicinally in Asia, although their alkaloid content suggests they are toxic."
407	2010. Woldemeskel, M./Styer, E.L.. Feeding Behavior-Related Toxicity due to <i>Nandina domestica</i> in Cedar Waxwings (<i>Bombycilla cedrorum</i>). <i>Veterinary Medicine International</i> . doi:10.4061/2010/818159: 1-4.	[Causes allergies or is otherwise toxic to humans? Yes, if ingested] " <i>Nandina domestica</i> berries contain cyanide and other alkaloids [7, 10]. For most cultivars of <i>N. domestica</i> , cyanogenesis is the most important intoxication factor [10]."
408	2009. Stone, K.R.. <i>Nandina domestica</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [2011, May 10]	[Creates a fire hazard in natural ecosystems? No evidence] "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."
409	2003. Miller, J.H.. <i>Nonnative Invasive Plants of Southern Forests - A Field Guide for Identification and Control</i> . USDA Forest Service, Southern Research Station, Asheville, NC	[Is a shade tolerant plant at some stage of its life cycle? Yes] "Ecology. Occurs under forest canopies and near forest edges. Shade tolerant. Seedlings frequent in vicinity of old plantings."
409	2005. Staples, G.W./Herbst, D.R.. <i>A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places</i> . Bishop Museum Press, Honolulu, HI	[Is a shade tolerant plant at some stage of its life cycle? Yes] "Heavenly-bamboo grows in full sun or partial shade and likes plenty of moisture without waterlogging of the soil. Plants grown in sun develop better foliage during the cooler days of autumn and winter, whereas leaves of plants grown in the shade are more likely to remain green."
410	2005. Staples, G.W./Herbst, D.R.. <i>A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places</i> . Bishop Museum Press, Honolulu, HI	[Tolerates a wide range of soil conditions? Yes] "Heavenly-bamboo likes a sheltered situation and does best on organically enriched, slightly acidic (pH about 6.0) soils with a high humus content. On alkaline soils, the leaves may turn an unsightly yellow; this chlorotic condition can be corrected by applying iron sulphate or chelated iron."

410	2009. Stone, K.R.. <i>Nandina domestica</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [2011, May 10]	[Tolerates a wide range of soil conditions? Yes] "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]."
411	2005. Staples, G.W./Herbst, D.R.. <i>A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places</i> . Bishop Museum Press, Honolulu, HI	[Climbing or smothering growth habit? No] "Evergreen shrub 4-10 inches tall, stems erect, canelike, 0.5-1 inches in diameter, usually unbranched."
412	2003. Weber, E.. <i>Invasive Plant Species of the World. A Reference Guide to Environmental Weeds</i> . CABI Publishing, Wallingford, UK	[Forms dense thickets? Yes] "The dense foliage of this shrub shades out native plants and prevents their regeneration. It forms extensive and dense stands displacing native vegetation."
501	2005. Staples, G.W./Herbst, D.R.. <i>A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places</i> . Bishop Museum Press, Honolulu, HI	[Aquatic? No] "Evergreen shrub 4-10 inches tall, stems erect, canelike, 0.5-1 inches in diameter, usually unbranched."
502	2011. Junsheng, Y./Boufford, D.E./Brach, A.R.. <i>Flora of China</i> . Vol. 19. - <i>Nandina</i> . Science Press Beijing, and Missouri Botanical Garden Press, St. Louis., http://flora.huh.harvard.edu/china/PDF/PDF19/Nandina.pdf	[Grass? No] Berberidaceae
503	2011. Junsheng, Y./Boufford, D.E./Brach, A.R.. <i>Flora of China</i> . Vol. 19. - <i>Nandina</i> . Science Press Beijing, and Missouri Botanical Garden Press, St. Louis., http://flora.huh.harvard.edu/china/PDF/PDF19/Nandina.pdf	[Nitrogen fixing woody plant? No] Berberidaceae
504	2011. Junsheng, Y./Boufford, D.E./Brach, A.R.. <i>Flora of China</i> . Vol. 19. - <i>Nandina</i> . Science Press Beijing, and Missouri Botanical Garden Press, St. Louis., http://flora.huh.harvard.edu/china/PDF/PDF19/Nandina.pdf	[Geophyte ? No] "Shrubs, evergreen, erect, to 3 m tall, glabrous, few branched. Branchlets reddish when young."
601	2011. Junsheng, Y./Boufford, D.E./Brach, A.R.. <i>Flora of China</i> . Vol. 19. - <i>Nandina</i> . Science Press Beijing, and Missouri Botanical Garden Press, St. Louis., http://flora.huh.harvard.edu/china/PDF/PDF19/Nandina.pdf	[Evidence of substantial reproductive failure in native habitat? No] No evidence
602	2003. Weber, E.. <i>Invasive Plant Species of the World. A Reference Guide to Environmental Weeds</i> . CABI Publishing, Wallingford, UK	[Produces viable seed? Yes] "Fruits are bright red or purplish, globular berries f c. 8 mm diameter, containing two seeds."
603	2005. Staples, G.W./Herbst, D.R.. <i>A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places</i> . Bishop Museum Press, Honolulu, HI	[Hybridizes naturally? No] "The single species of <i>Nandina</i> , now widespread from India to Japan, was perhaps originally native to central China." [No evidence of intergeneric hybridization]
604	2009. Stone, K.R.. <i>Nandina domestica</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [2011, May 10]	[Self-compatible or apomictic? Unknown] "Pollination and breeding system: No information is available on this topic."
604	2011. Junsheng, Y./Boufford, D.E./Brach, A.R.. <i>Flora of China</i> . Vol. 19. - <i>Nandina</i> . Science Press Beijing, and Missouri Botanical Garden Press, St. Louis., http://flora.huh.harvard.edu/china/PDF/PDF19/Nandina.pdf	[Self-compatible or apomictic? Unknown] "Flowers bisexual, 3-merous; bracteoles present. Sepals numerous, spirally arranged. Petals 6, larger than sepals, basally without nectaries. Anthers dehiscing by longitudinal slits; pollen grains prolate, 3-polyporate, exine distinctly reticulate. Ovary ellipsoid; placentation submarginal; style short; stigma entire or crisped." [Flowers are perfect, but unknown if plants are self-compatible]

605	2009. Stone, K.R.. <i>Nandina domestica</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [2011, May 10]	[Requires specialist pollinators? Unknown] "Pollination and breeding system: No information is available on this topic."
605	2011. Junsheng, Y./Boufford, D.E./Brach, A.R.. Flora of China. Vol. 19. - <i>Nandina</i> . Science Press Beijing, and Missouri Botanical Garden Press, St. Louis., http://flora.huh.harvard.edu/china/PDF/PDF19/Nandina.pdf	[Requires specialist pollinators? Unknown] "Inflorescences erect, 20–35 cm. Flowers cream or white. Sepals ovate-triangular or ovate oblong, 1–4 mm. Petals oblong, ca. 4.2 × 2.5 mm, apex obtuse. Stamens ca. 3.5 mm; anther connective prolonged." [flowers do not appear to be highly specialized, but no information on pollinators was found]
606	2003. Weber, E.. <i>Invasive Plant Species of the World. A Reference Guide to Environmental Weeds</i> . CABI Publishing, Wallingford, UK	[Reproduction by vegetative fragmentation? Yes] "The plant has rhizomes."
606	2005. Staples, G.W./Herbst, D.R.. <i>A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places</i> . Bishop Museum Press, Honolulu, HI	[Reproduction by vegetative fragmentation? Yes] "Heavenly-bamboo is usually propagated by vegetative methods such as division of clumps to remove sucker shoots..."
606	2009. Trueblood, C.E.. <i>An Invasive Species Assessment System for the North Carolina Horticultural Industry</i> . MSc Thesis. North Carolina State University, Raleigh, NC	[Reproduction by vegetative fragmentation? Yes] "Colonizes vegetatively through root sprouts (Miller 2003). Spreads by root suckers and rhizomes (IF/IFAS 2008)."
606	2010. Murray, B.R./Phillips, M.L.. Investment in seed dispersal structures is linked to invasiveness in exotic plant species of south-eastern Australia. <i>Biological Invasions</i> . 12: 2265–2275.	[Reproduction by vegetative fragmentation? Yes] "Table 1 The dataset of naturalized exotic plant species of Royal National Park (south-eastern Australia) and attribute values for invasion status (0 = non-invasive, 1 = invasive), minimum residence time (MRT = 2009—year of first record, where 2009 is the present year), growth form (grass, herb, shrub, tree, climber), seed mass (total diaspore mass, mg, without mass of dispersal structures) and capacity for vegetative spread (1 = no observed capacity, 2 = observed capacity for vegetative spread)" [<i>Nandina domestica</i> listed as having the capacity for vegetative spread]
607	2002. Cherry, H.M.. <i>Ecophysiology and control of Nandina domestica</i> Thunb. MSc Thesis. University of Florida, Gainesville, FL	[Minimum generative time (years)? 4+] "plants as young as 18 months can produce numerous fruits"
701	2003. Weber, E.. <i>Invasive Plant Species of the World. A Reference Guide to Environmental Weeds</i> . CABI Publishing, Wallingford, UK	[Propagules likely to be dispersed unintentionally? No] No evidence
701	2009. Stone, K.R.. <i>Nandina domestica</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [2011, May 10]	[Propagules likely to be dispersed unintentionally? No] No evidence
702	2005. Staples, G.W./Herbst, D.R.. <i>A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places</i> . Bishop Museum Press, Honolulu, HI	[Propagules dispersed intentionally by people? Yes] "Heavenly-bamboo is often found growing in the gardens of local Japanese families, who typically plant it to the left of the entry to the home or yard, a practice deeply rooted in Japanese animist beliefs that hold the plant to be a protection against evil. It is also a ubiquitous component of Japanese-style gardens in Hawaii and elsewhere. The flowering and fruiting branches are used in floral arrangements, along with sprigs of pine, cut sections of bamboo, and sprays of flowering plum, especially at New Year."
702	2009. Trueblood, C.E.. <i>An Invasive Species Assessment System for the North Carolina Horticultural Industry</i> . MSc Thesis. North Carolina State University, Raleigh, NC	[Propagules dispersed intentionally by people? Yes] "The annual estimated wholesale value attributed to this species is \$26,964,300"
703	2009. Stone, K.R.. <i>Nandina domestica</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [2011, May 10]	[Propagules likely to disperse as a produce contaminant? No evidence] "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]."
704	2003. Weber, E.. <i>Invasive Plant Species of the World. A Reference Guide to Environmental Weeds</i> . CABI Publishing, Wallingford, UK	[Propagules adapted to wind dispersal? No] "Fruits are bright red or purplish, globular berries f c. 8 mm diameter, containing two seeds....Berries are abundantly produced and seeds dispersed by birds."

705	2009. Stone, K.R.. <i>Nandina domestica</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [2011, May 10]	[Propagules water dispersed? Possibly] "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]."
706	2000. Richardson, D.M./Allsopp, N./D'Antonio, C.M./Milton, S.J./Rejmanek, M.. Plant invasions - the role of mutualisms. <i>Biological Reviews</i> . 75: 65-93.	[Propagules bird dispersed? Apparently not in California] "Although some fleshy fruited plants with small seeds are avoided by generalist dispersers (e.g. <i>Melia azederach</i> and <i>Nandina domestica</i> introduced to California, U.S.A., are never dispersed;...With the exception of a few fleshy-fruited species that are probably not dispersed because of 'unfavourable' chemistry (e.g. <i>Nandina domestica</i> in California, U.S.A.), we believe that it will be relatively easy to match fruit characteristics with potential dispersers in assessing invasion potential." [suggests possibility that generalist dispersers in Hawaii and other tropical islands may also avoid fruits]
706	2003. Weber, E.. <i>Invasive Plant Species of the World. A Reference Guide to Environmental Weeds</i> . CABI Publishing, Wallingford, UK	[Propagules bird dispersed? Yes] "Fruits are bright red or purplish, globular berries f c. 8 mm diameter, containing two seeds....Berries are abundantly produced and seeds dispersed by birds."
706	2010. Woldemeskel, M./Styer, E.L.. Feeding Behavior-Related Toxicity due to <i>Nandina domestica</i> in Cedar Waxwings (<i>Bombycilla cedrorum</i>). <i>Veterinary Medicine International</i> . doi:10.4061/2010/818159: 1-4.	[Propagules bird dispersed? Yes] "The species and its dwarf varieties are popular landscape items. The plant has naturalized and invaded habitats in southeastern and other areas of the USA. The bright berries are beloved by birds and attract Cedar Waxwings, mockingbirds, and robins."
707	2009. Stone, K.R.. <i>Nandina domestica</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [2011, May 10]	[Propagules dispersed by other animals (externally)? No] "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]." [adapted for internal dispersal, with no means of external attachment]
708	1996. Nelson, G.. <i>The shrubs and woody vines of Florida: a reference and field guide</i> . Pineapple Press Inc, Sarasota, FL	[Propagules survive passage through the gut? Yes] "The fruit of this species is relished by birds. Homeowners often report finding <i>nandina</i> seedlings that have apparently been sewn with bird droppings. Unfortunately, birds have also encouraged this plant to spread into natural plant communities. If left unchecked, it is likely to become an extremely troublesome weed."
708	2003. Weber, E.. <i>Invasive Plant Species of the World. A Reference Guide to Environmental Weeds</i> . CABI Publishing, Wallingford, UK	[Propagules survive passage through the gut? Yes] "Fruits are bright red or purplish, globular berries f c. 8 mm diameter, containing two seeds....Berries are abundantly produced and seeds dispersed by birds."
801	2003. Weber, E.. <i>Invasive Plant Species of the World. A Reference Guide to Environmental Weeds</i> . CABI Publishing, Wallingford, UK	[Prolific seed production (>1000/m ²)? Possibly] "An upright, glabrous shrub with erect unbranched, thin and bamboo-like stems up to 2.5 m all...Fruits are bright red or purplish, globular-berries of c. 8 mm diameter, containing two seeds." [Relatively small-statured plant two few-seeded fruits. Unlikely to produce high seed densities, but see Stone 2009]
801	2009. Stone, K.R.. <i>Nandina domestica</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [2011, May 10]	[Prolific seed production (>1000/m ²)? Possibly] "When mature, sacred bamboo produces a heavy fruit crop (review by [5]), producing hundreds of fruits per plant (review by [12])." [potentially high seed densities in heavily infested areas]
802	2009. Stone, K.R.. <i>Nandina domestica</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [2011, May 10]	[Evidence that a persistent propagule bank is formed (>1 yr)? Unknown] "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."
803	2001. Langeland, K.A./Stocker, R.K.. <i>Control of Non-native Plants in Natural Areas of Florida</i> . Institute of Food & Agricultural Sciences, University of Florida, Gainesville, FL http://mrec.ifas.ufl.edu/ldspmg/Ldsp%20Turf%20Mgmt/PDFfiles/WG20900.pdf	[Well controlled by herbicides? Yes] "Treatment: Basal bark application of 15% Garlon 4 in mineral oil. Collect and destroy attached fruits."

803	2003. Miller, J.H.. Nonnative Invasive Plants of Southern Forests - A Field Guide for Identification and Control. USDA Forest Service, Southern Research Station, Asheville, NC	[Well controlled by herbicides? Yes] "Thoroughly wet all leaves with glyphosate herbicide as a 1-percent solution in water (4 ounces per 3-gallon mix) with a surfactant (August to October). Or, apply Garlon 4 as a 20 percent solution in commercially available basal oil, diesel fuel, or kerosene (2.5 quarts per 3-gallon mix) with a penetrant (check with herbicide distributor) to young bark as a basal spray. For stems too tall for foliar sprays, cut large stems and immediately treat the stumps with one of the following herbicides in water with a surfactant: Arsenal AC* as a 10-percent solution (1 quart per 3-gallon mix) or a glyphosate herbicide as a 20-percent solution (2.5 quarts per 3-gallon mix)."
803	2003. Weber, E.. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	[Well controlled by herbicides? Yes] "An effective control is cutting the stems close to the ground and treating the stumps with a glyphosate or triclopyr herbicide."
804	2003. Weber, E.. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	[Tolerates, or benefits from, mutilation, cultivation, or fire? Yes] "Seedlings can easily be hand pulled or dug out. Since the plant develops a strong taproot, digging out large individuals is difficult. An effective control is cutting the stems close to the ground and treating the stumps with a glyphosate or triclopyr herbicide." [Presence of taproot and necessity of treating cut stumps suggests that plant will tolerate and resprout from cutting]
804	2005. Staples, G.W./Herbst, D.R.. A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places. Bishop Museum Press, Honolulu, HI	[Tolerates, or benefits from, mutilation, cultivation, or fire? Yes] "Pruning is necessary to shape the plant and to keep the larger forms from getting too tall. Cutting the stems down to the ground induces a flush of new growth of colorful young foliage to emerge from the base."
804	2009. Trueblood, C.E.. An Invasive Species Assessment System for the North Carolina Horticultural Industry. MSc Thesis. North Carolina State University, Raleigh, NC	[Tolerates, or benefits from, mutilation, cultivation, or fire? Yes] "Cut roots readily resprout (USDA Forest Service 2006)."
805	2009. Trueblood, C.E.. An Invasive Species Assessment System for the North Carolina Horticultural Industry. MSc Thesis. North Carolina State University, Raleigh, NC	[Effective natural enemies present locally? Unknown] "No known biological control agents (UF/IFAS 2008)." [Unknown for Hawaii or other tropical islands]