

Family: *Celastraceae*

Taxon: *Celastrus orbiculatus*

Synonym: *Celastrus insularis* Koidz.
Celastrus lancifolius Nakai
Catha articulata G.Don
Celastrus articulatus Thunb.

Common Name: Oriental bittersweet
 Chinese bittersweet
 Asian bittersweet
 round-leaved bittersweet
 climbing spindle berry

Questionnaire : current 20090513 **Assessor:** Assessor **Designation:** H(HPWRA)
Status: Assessor Approved **Data Entry Person:** Assessor **WRA Score** 13.5

101	Is the species highly domesticated?	y=-3, n=0	n
102	Has the species become naturalized where grown?	y=1, n=-1	
103	Does the species have weedy races?	y=1, n=-1	
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)	High
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	n
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)	
303	Agricultural/forestry/horticultural weed	n=0, y = 2*multiplier (see Appendix 2)	y
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	y
402	Allelopathic	y=1, n=0	
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	n
406	Host for recognized pests and pathogens	y=1, n=0	y
407	Causes allergies or is otherwise toxic to humans	y=1, n=0	n
408	Creates a fire hazard in natural ecosystems	y=1, n=0	
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	y
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	y
604	Self-compatible or apomictic	y=1, n=-1	
605	Requires specialist pollinators	y=-1, n=0	n
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	y
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	y
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	n
802	Evidence that a persistent propagule bank is formed (>1 yr)	y=1, n=-1	n
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 13.5

Supporting Data:

101	2011. Fryer, J.L.. <i>Celastrus orbiculatus</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [Accessed 15 Oct 2013]	[Is the species highly domesticated? No]
102	2013. WRA Specialist. Personal Communication.	NA
103	2013. WRA Specialist. Personal Communication.	NA
201	2011. Fryer, J.L.. <i>Celastrus orbiculatus</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [Accessed 15 Oct 2013]	[Species suited to tropical or subtropical climate(s) 0-Low] "Oriental bittersweet is native to Korea, China, and Japan [114]. Its southern limit in southeastern Asia is along the Yangtze River watershed (Cheng and Huang 1999 cited in [95]). Oriental bittersweet is nonnative in North America [42, 64, 70, 110, 129, 166, 167, 174] and New Zealand [167,173]. In North America, Oriental bittersweet is sporadically distributed from Ontario and Quebec south through the Great Lakes states, New England, and the Southeast to Arkansas, Tennessee, Florida, Louisiana, and the southeastern edge of the Great Plains [24,24,47,70]."
202	2011. Fryer, J.L.. <i>Celastrus orbiculatus</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [Accessed 15 Oct 2013]	[Quality of climate match data 2-High]
203	2003. Williams, P.A./Timmins, S.M.. Climbing spindle berry (<i>Celastrus orbiculatus</i> Thunb.) biology, ecology, and impacts in New Zealand. Science for Conservation 234. Department of Conservation, Wellington, New Zealand	[Broad climate suitability (environmental versatility)? Yes] "In Japan and Korea, climbing spindle berry grows from the lowlands to the mountains, from 100 to 1400 m a.s.l. (Hou 1955; Ohwi 1965). The agro climatic analogues constructed by Nuttinson (1947) for China-North America and Japan-North America suggest that climbing spindle berry can tolerate a very wide range of climates (Patterson 1974). Its potential range in North America extends from Nova Scotia to North Carolina."
203	2011. Fryer, J.L.. <i>Celastrus orbiculatus</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [Accessed 15 Oct 2013]	[Broad climate suitability (environmental versatility)? Yes] "Oriental bittersweet tolerates a wide range of climatic conditions [65,113,120]. It is native to temperate and tropical regions on southeastern Asia [167]. Its elevational range is from sea level to 4,600 feet (0-1,400 m) in the United States [24,103,135]; 1,500 to 7,200 feet (450-2,200 m) elevation in its native range of southeastern Asia (Cheng and Huang 1999 cited in [95]); and from sea level to 1,800 feet (0-540 m) in New Zealand [173]. In Giant City Park, Illinois, Oriental bittersweet presence was positively associated with relatively high elevation (x=669 feet (204 m)), flat sites (P<0.001 for both variables) [117,118]."
204	2003. Williams, P.A./Timmins, S.M.. Climbing spindle berry (<i>Celastrus orbiculatus</i> Thunb.) biology, ecology, and impacts in New Zealand. Science for Conservation 234. Department of Conservation, Wellington, New Zealand	[Native or naturalized in regions with tropical or subtropical climates? No] "It was first collected as a naturalised plant in 1912 (Patterson 1973). It is now naturalised in 21 states from Maine to Georgia: all of New England, west to the Great Plains and up into Ontario, and south to most of the Atlantic coastal states (Dreyer et al. 1987; Westbrook 1998). It is not known in the wild on the Pacific coast of North America."
205	2011. Fryer, J.L.. <i>Celastrus orbiculatus</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [Accessed 15 Oct 2013]	[Does the species have a history of repeated introductions outside its natural range? Yes] "It was introduced in the United States around 1860 as an ornamental and for erosion control [131]. It spread to Connecticut by 1916, Massachusetts by 1919, and New Hampshire by 1938 [105]. By 1974, Oriental bittersweet had spread to 33 states [94,120] and was considered invasive in 21 [94]. As of 2011, it was widespread in the Northeast and sporadic [32] but locally dominant [24] farther south [32]. "
301	2011. Fryer, J.L.. <i>Celastrus orbiculatus</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [Accessed 15 Oct 2013]	[Naturalized beyond native range? Yes] "Oriental bittersweet is most common and invasive in New York, coastal Connecticut, and the southern Appalachian Mountains [24]. In 2008, it covered at estimated 8,960 acres (3,630 ha) in forests of the Southeast and South [107]. Using biogeographical models, Leicht [87] predicted that Oriental bittersweet could increase in New England and spread further north. Based on Oriental bittersweet's native range and habitat preferences, others also expect Oriental bittersweet to expand its range in the United States and Canada [27,81]."

302	2011. Fryer, J.L.. <i>Celastrus orbiculatus</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [Accessed 15 Oct 2013]	[Garden/amenity/disturbance weed? Disturbance adapted] "Disturbance increases the likelihood of successful Oriental bittersweet establishment [30]."
303	2011. Fryer, J.L.. <i>Celastrus orbiculatus</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [Accessed 15 Oct 2013]	[Agricultural/forestry/horticultural weed? Yes] "Oriental bittersweet may smother or kill timber trees and understory vegetation [125]. Girdling and stem damage from Oriental bittersweet stems lowers the value of timber trees that host Oriental bittersweet. Where it was present before tree harvest, Oriental bittersweet can rapidly overtake a site after harvest. Its sprouts may overtop understory species and overstory trees. On the Pisgah National Forest, Oriental bittersweet covered sapling-sized hardwood and eastern white pine (<i>Pinus strobus</i>) regeneration on small clearcuts [104]. In a Massachusetts clipping experiment, Oriental bittersweet growth ranged from 6.9 to 15 feet (2.1-4.7 m) in 1 year. In contrast, bigtooth aspen (<i>Populus grandidentata</i>) sprouts grew from 3.0 to 5.9 feet (0.9-1.8 m) in 1 year, and yellow poplar sprouts averaged 4.6 feet (1.4 m) in 1 year (review by [31]). On the Bent Creek Experimental Forest, a high-quality stand of upland oaks was clearcut in the summer of 1977. Oak site index before harvest was above 80, with a basal overstory area of 120 feet ² (11 m ²). Preharvest Oriental bittersweet density was 830 seedlings/acre and 27 saplings/acre (seedlings were <0.6 inch (2.0 cm) DBH; saplings were >0.6 inch DBH). Seven years after tree harvest, the canopy was nearly 100% Oriental bittersweet [104]."
304	2003. Weber, E.. <i>Invasive Plant Species of the World. A Reference Guide to Environmental Weeds</i> . CABI Publishing, Wallingford, UK	[Environmental weed? Yes] "It grows along the floor, into the canopies, and its impacts are blanketing and shading out the native vegetation, killing trees due to strangulation, and increasing susceptibility to wind and ice damage of host trees, reducing forest regeneration in invaded areas."
304	2011. Fryer, J.L.. <i>Celastrus orbiculatus</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [Accessed 15 Oct 2013]	[Environmental weed? Yes] "Oriental bittersweet is considered a "severe" pest plant in the Northeast and Southeast [152]. In the Northeast, it is listed as a high threat in deciduous, coniferous, and mixed conifer-deciduous forests, old fields, grasslands, riparian areas, and fresh wetlands; and an unknown threat in tidal wetlands [21]. On the west end of Long Island, for example, Oriental bittersweet was the most abundant nonnative species on Jamaica Bay Wildlife Refuge, where it invaded old fields, thickets, and woodlands [146]." ... "Effects on diversity: Oriental bittersweet can displace native species. Its thickets [104] and climbing stems cast too much shade for many native plant species to establish and grow. For example, Oriental bittersweet canopies inhibited establishment of understory spring ephemerals in Illinois [65]. Along the Blue Ridge Parkway in North Carolina, Oriental bittersweet cover was negatively associated with native plant diversity [48]."
305	2012. Randall, R.P.. <i>A Global Compendium of Weeds</i> . 2nd Edition. Department of Agriculture and Food, Western Australia	[Congeneric weed? No. Although <i>C. scandens</i> may have become naturalized in locations]
401	2003. Williams, P.A./Timmins, S.M.. <i>Climbing spindle berry (Celastrus orbiculatus Thunb.) biology, ecology, and impacts in New Zealand. Science for Conservation 234</i> . Department of Conservation, Wellington, New Zealand	[Produces spines, thorns or burrs? Yes] "Branches have noticeable lenticels and the outermost scales of the winter buds are often transformed into sharp spines 1-2 cm long."
401	2008. Wu, Z.Y./Raven, P.H./Hong, D.Y. (eds.). <i>Flora of China</i> . Vol. 11 (Oxalidaceae through Aceraceae). Science Press & Missouri Botanical Garden Press, Beijing & St. Louis	[Produces spines, thorns or burrs? No] "A shrub or vine, climbing up to 12 m height, with twining young stems and a pair of spines at each bud."
401	2011. Fryer, J.L.. <i>Celastrus orbiculatus</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [Accessed 15 Oct 2013]	[Produces spines, thorns or burrs? Yes] "Fruits develop next to the vegetative buds [26]. Outer vegetative bud scales may be spiny [24]."
402	2010. Pisula, N./Meiners, S.J.. <i>Relative allelopathic potential of invasive plant species in a young disturbed woodland</i> . <i>Journal of the Torrey Botanical Society</i> . 137(1): 81-87.	[Allelopathic? Possibly Yes. Demonstrated in lab setting] "We conducted laboratory bioassays for 10 co-occurring non-native species to determine the relative strength of their allelopathic potential." ... "Similarly, the two lianas differed in their allelopathic potential with <i>Celastrus orbiculatus</i> having a much greater effect on seed germination than <i>Lonicera japonica</i> ." ... "Four species, <i>Ailanthus altissima</i> , <i>Alliaria petiolata</i> , <i>Celastrus orbiculatus</i> , and <i>Microstegium vimineum</i> all exhibited strong germination inhibition and warrant additional study in the field."

403	2011. Fryer, J.L.. <i>Celastrus orbiculatus</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [Accessed 15 Oct 2013]	[Parasitic? No] "Oriental bitterweet is a deciduous liana [175]. The stems are woody and twining [42,88,114,129]. They may reach 66 feet (20 m) in length and 4 inches (10 cm) in width [24,25,143], depending upon stem age and supporting vegetation [24]."
404	2011. Fryer, J.L.. <i>Celastrus orbiculatus</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [Accessed 15 Oct 2013]	[Unpalatable to grazing animals? Yes] "Oriental bitterweet browse is apparently unpalatable to herbivores. Although cattle, white-tailed deer, and lagomorphs browse Oriental bitterweet's congener, American bitterweet [16], browsing animals do not similarly utilize Oriental bitterweet [23]."
405	2003. Williams, P.A./Timmins, S.M.. Climbing spindle berry (<i>Celastrus orbiculatus</i> Thunb.) biology, ecology, and impacts in New Zealand. Science for Conservation 234. Department of Conservation, Wellington, New Zealand	[Toxic to animals? No evidence]
405	2008. Wagstaff, D.J.. International poisonous plants checklist: an evidence-based reference. CRC Press, Boca Raton, FL	[Toxic to animals? No evidence]
405	2011. Fryer, J.L.. <i>Celastrus orbiculatus</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [Accessed 15 Oct 2013]	[Toxic to animals? Unpalatable, but no evidence of toxicity] "Oriental bitterweet browse is apparently unpalatable to herbivores. Although cattle, white-tailed deer, and lagomorphs browse Oriental bitterweet's congener, American bitterweet [16], browsing animals do not similarly utilize Oriental bitterweet [23]."
406	2011. Fryer, J.L.. <i>Celastrus orbiculatus</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [Accessed 15 Oct 2013]	[Host for recognized pests and pathogens? Yes] "Oriental bitterweet is an alternate host for <i>Xylella fastidiosa</i> . This bacterium vectors several crop diseases including Pierce's grapevine (<i>Vitis</i>) disease, periwinkle (<i>Vinca</i>) wilt, plum leaf scorch and phony peach (<i>Prunus</i>) disease, and variegated chlorosis (affects several genera including oaks, elms, sycamores, citrus (<i>Citrus</i>), and mulberries (<i>Morus</i>)) [101]."
407	2011. Fryer, J.L.. <i>Celastrus orbiculatus</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [Accessed 15 Oct 2013]	[Causes allergies or is otherwise toxic to humans? No evidence] "Oriental bitterweet is an Asian folk medicine used for treating rheumatoid arthritis and bacterial infections. Medical and pharmacological studies show that Oriental bitterweet derivatives have antitumor, antiinflammatory, antioxidant, antibacterial, and insecticidal properties [66,67,108]. One Oriental bitterweet derivative shows ability to reverse multidrug resistance of cancer cells to cancer-treatment drugs [75,76]."
408	2011. Fryer, J.L.. <i>Celastrus orbiculatus</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [Accessed 15 Oct 2013]	[Creates a fire hazard in natural ecosystems? Possibly] "Oriental bitterweet may alter fuel structure and loads (review by [21], communication by [133]), although quantitative data of Oriental bitterweet fuel loads were lacking as of early 2011. Oriental bitterweet may act as a ladder fuel by growing up and over supporting shrubs and trees [34,60], which increases the chance that a fire will crown [21]. Oriental bitterweet can also support other lianas and vines [34], possibly enabling other twining species to become ladder fuels as well. It also contributes to understory fuel loads. In total, it contributes substantial biomass to forests of the Northeast [49]. Oriental bitterweet sometimes attains heavy understory cover in hardwood and coniferous communities, such as yellow-poplar, that historically had sparse understories (for example, [124]). Forest understories with Oriental bitterweet or a mix of Oriental bitterweet and other nonnative invasive woody shrubs, such as Japanese honeysuckle and Japanese barberry, can have substantially greater overall cover than uninvaded forests([19], review by [21]). On opens sites where host plants are scarce, Oriental bitterweet's sprawling habit may also increase fuel continuity and loads over historic levels. Studies are needed on how Oriental bitterweet affects fuel characteristics." ... "A dearth of fire studies makes it unclear how Oriental bitterweet may affect or alter fire regimes in plant communities where it is present. Oriental bitterweet's climbing habit can alter forest structure [26,34,93] and may carry fire into the canopies of forests that historically did not experience crown fires. The fire ecology of Oriental bitterweet is poorly understood [132], and research is needed to determine Oriental bitterweet's impact on fire behavior and fire regimes."
409	2003. Weber, E.. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	[Is a shade tolerant plant at some stage of its life cycle? Yes] "Seedlings are very shade tolerant; they respond to gaps by quickly increasing photosynthesis and growth rate."

409	2011. Fryer, J.L.. <i>Celastrus orbiculatus</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [Accessed 15 Oct 2013]	[Is a shade tolerant plant at some stage of its life cycle? Yes] "Oriental bittersweet shows rapid growth under partial to full sun [3,102], although seedlings grow slower in low than in high light [49,119]. In Massachusetts, artificially shaded Oriental bittersweet transplants showed greatest aboveground biomass gain under 28% of full sunlight. Mean aboveground biomass 1 year after transplanting was significantly different ($P=0.002$) under 100% full sunlight (0.9 g), 28% of full sunlight (14.4 g), and 2% of full sunlight (0.3 g) [29]. Oriental bittersweet growing in partial to full sun can overtop 3- to 7-foot (1-2 m) tall associated vegetation after one growing season [31]. On mesic sites in full sunlight, Oriental bittersweet may grow 10 to 12 feet (3.3-3.7 m)/year [102]. In Connecticut, Oriental bittersweet grew 10 feet (3 m)/year [120]. The Tennessee Exotic Plant Pest Council [154] reported annual growth rates of 1 to 12 feet (0.3-3.0 m) in the first 7 years after establishment, with little growth thereafter. Oriental bittersweet may persist in a densely shaded understory for many years, then respond with rapid growth when disturbance opens the canopy [102,120]. " ... "Oriental bittersweet is shade [31,49] and light tolerant at all life stages."
410	2011. Fryer, J.L.. <i>Celastrus orbiculatus</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [Accessed 15 Oct 2013]	[Tolerates a wide range of soil conditions? Yes] "Oriental bittersweet grows on forest, alluvial, and floodplain [129,134,141], and glacial till [50] soils of all textures but of generally acidic pH. Oriental bittersweet typically grows in loam [94,158], sand, and silt [50,134] soils."
411	2003. Weber, E.. <i>Invasive Plant Species of the World. A Reference Guide to Environmental Weeds</i> . CABI Publishing, Wallingford, UK	[Climbing or smothering growth habit? Yes] "A shrub or vine, climbing up to 12 m height, with twining young stems and a pair of spines at each bud."
411	2003. Williams, P.A./Timmins, S.M.. <i>Climbing spindle berry (Celastrus orbiculatus Thunb.) biology, ecology, and impacts in New Zealand</i> . Science for Conservation 234. Department of Conservation, Wellington, New Zealand	[Climbing or smothering growth habit? Yes] "Climbing spindle berry stems are typical of climbing vines because they twine around other plants and kill them by restricting the flow of nutrients and water (Lutz 1943). Once they have reached the canopy they grow over the crowns of the host and completely smother them. This eventually leads to canopy collapse."
411	2011. Fryer, J.L.. <i>Celastrus orbiculatus</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [Accessed 15 Oct 2013]	[Climbing or smothering growth habit? Yes] "Oriental bittersweet's growth habit is climbing and/or sprawling. It uses woody shrubs and/or trees for structural support, intertwining its branches around support trunks and branches. Branches may eventually overtop or shade out supporting plants. In Rock Creek Park, Washington DC, Oriental bittersweet used other bole-climbing lianas and vines including Virginia creeper (<i>Parthenocissus quinquefolia</i>), poison-ivy, and English ivy (<i>Hedera helix</i>) for initial structural support. After twining around these lianas, Oriental bittersweet branches grew into and twined around tree crowns. This climbing habit enabled Oriental bittersweet to grow above other lianas and access the tops of the largest trees (3.7 feet (1.1 m DBH)) in the Park [128]. In red maple, American beech, red oak, and black oak forests on the plain of Lake Michigan, jack pine and white oak were more likely to support Oriental bittersweet than other overstory species ($P<0.02$). In general, trees larger than 0.3 inch (10 cm) in DBH were more likely to support lianas than trees of smaller girth ($P<0.03$), although this varied with liana and host species. Oriental bittersweet's DBH did not significantly increase with increasing DBH of host trees [88]."
412	2011. Fryer, J.L.. <i>Celastrus orbiculatus</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [Accessed 15 Oct 2013]	[Forms dense thickets? Yes] "Oriental bittersweet assumes a sprawling form on open sites. Sprawling Oriental bittersweet branches may form impenetrable thickets [3,26]."
501	2011. Fryer, J.L.. <i>Celastrus orbiculatus</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [Accessed 15 Oct 2013]	[Aquatic? No] "In the United States, Oriental bittersweet grows on woodland [174] and forest [3,94,97,98] edges; in thickets, woodlands, and forests [3,42,110,129,152,166]; and on coastal wetlands, beaches, and saltmarsh edges [24,152]. Oriental bittersweet is common on disturbed sites such as roadsides [3,117,129], logged forests, and old fields [3,129]. It is also common in urban areas, from which it may disperse onto wildlands. Most Oriental bittersweet specimens in West Virginia herbaria had been collected in open forests [59]."
502	2008. Wu, Z.Y./Raven,P.H./Hong, D.Y. (eds.). <i>Flora of China</i> . Vol. 11 (Oxalidaceae through Aceraceae). Science Press & Missouri Botanical Garden Press, Beijing & St. Louis	[Grass? No] Celastraceae
503	2008. Wu, Z.Y./Raven,P.H./Hong, D.Y. (eds.). <i>Flora of China</i> . Vol. 11 (Oxalidaceae through Aceraceae). Science Press & Missouri Botanical Garden Press, Beijing & St. Louis	[Nitrogen fixing woody plant? No] Celastraceae

504	2008. Wu, Z.Y./Raven,P.H./Hong, D.Y. (eds.). Flora of China. Vol. 11 (Oxalidaceae through Aceraceae). Science Press & Missouri Botanical Garden Press, Beijing & St. Louis	[Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)? No] "Deciduous twining shrubs"
504	2010. Gordon, D.R./Mitterdorfer, B./Pheloung, P.C. et al.. Guidance for addressing the Australian Weed Risk Assessment questions. Plant Protection Quarterly. 25(2): 56-74.	[Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)? No] "This question is specifically to deal with plants that have specialized organs and should not include plants merely with rhizomes/ stolons"
601	2008. Wu, Z.Y./Raven,P.H./Hong, D.Y. (eds.). Flora of China. Vol. 11 (Oxalidaceae through Aceraceae). Science Press & Missouri Botanical Garden Press, Beijing & St. Louis	[Evidence of substantial reproductive failure in native habitat? No] No evidence
602	2011. Fryer, J.L.. <i>Celastrus orbiculatus</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [Accessed 15 Oct 2013]	[Produces viable seed? Yes] "Oriental bittersweet regenerates by sprouting and from seed. Its invasiveness is due, in part, to its superior ability to establish from both sprouts and seeds compared to most native lianas and other associated native woody species [49,96,106,120,129,143]. Based on Oriental bittersweet's ability to spread from both root sprouts and bird-dispersed seed and its use of multiple breeding systems (see the Regeneration Processes links above), Huebner [62] suggested that Oriental bittersweet may become the fastest spreading invasive species among Oriental bittersweet, Japanese stiltgrass, garlic mustard (<i>Alliaria officinalis</i>), tree-of-heaven (<i>Ailanthus altissima</i>), and European buckthorn (<i>Rhamnus cathartica</i>) [62]."
603	2003. Williams, P.A./Timmins, S.M.. Climbing spindle berry (<i>Celastrus orbiculatus</i> Thunb.) biology, ecology, and impacts in New Zealand. Science for Conservation 234. Department of Conservation, Wellington, New Zealand	[Hybridizes naturally? Yes] "Pure populations of the native North American bittersweet are potentially threatened by interspecific hybridisation with the introduced species (Dreyer 1994; Pooler et al. 2002). <i>C. orbiculatus</i> x <i>C. scandens</i> hybrids produced seed with less dormancy than the native seeds (Pooler et al. 2002), but it may be significant that hybrids produced flowers, but no fruit, in their fourth year (White & Bowden 1947)."
603	2011. Fryer, J.L.. <i>Celastrus orbiculatus</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [Accessed 15 Oct 2013]	[Hybridizes naturally? Yes] "Oriental and American bittersweet have the potential to hybridize. Although the current extent of Oriental bittersweet x American bittersweet hybridization in the wild is unknown, the 2 bittersweets are cross-fertile in the laboratory [127,172,176]. Hybrids are not widely reported in the field; however, this may be due to the difficulty in identifying bittersweet hybrids. Dreyer and others [26] noted a bittersweet plant in Connecticut that produced 2 distinct types of pollen. Both Oriental and American bittersweet were present in the study area, and the authors speculated that the individual may have been a hybrid. Genetic studies of field specimens are needed to determine levels of hybridization and introgression between Oriental bittersweet and American bittersweet."
604	2003. Williams, P.A./Timmins, S.M.. Climbing spindle berry (<i>Celastrus orbiculatus</i> Thunb.) biology, ecology, and impacts in New Zealand. Science for Conservation 234. Department of Conservation, Wellington, New Zealand	[Self-compatible or apomictic? Generally no, but potentially possible] "Climbing spindle berry produces small greenish flowers that usually become unisexual by abortion of male or female organs, thus making the plants functionally dioecious (Brizicky 1964). Vines may occasionally develop both unisexual and perfect flowers and become polygamodioecious (Gleason & Cronquist 1991). Monoecious plants have occasionally been reported (Hou 1955)."
604	2011. Fryer, J.L.. <i>Celastrus orbiculatus</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [Accessed 15 Oct 2013]	[Self-compatible or apomictic? Probably No. Typically functionally dioecious] "Oriental bittersweet uses both dioecious and perfect breeding systems [62]. This species is typically "functionally dioecious" because early abortion of either male or female organs makes most individual plants unisexual [10]. Plants occasionally develop both unisexual and perfect flowers, becoming polygamodioecious [42,129], and some plants are reportedly monoecious [58]."
605	2003. Williams, P.A./Timmins, S.M.. Climbing spindle berry (<i>Celastrus orbiculatus</i> Thunb.) biology, ecology, and impacts in New Zealand. Science for Conservation 234. Department of Conservation, Wellington, New Zealand	[Requires specialist pollinators? No] "Hymenopterous insects, particularly bees, are the main known pollinators in North America (Brizicky 1964). These insects are abundant in New Zealand so we presume that pollination is not limited. In North America, pollen viability ranged from 57% to 74% at three sites with climbing spindle berry <i>sensu stricta</i> but was lower at a site where there may have been hybridising with American bittersweet (Dreyer et al. 1987)."
605	2011. Fryer, J.L.. <i>Celastrus orbiculatus</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [Accessed 15 Oct 2013]	[Requires specialist pollinators? No] "Hymenoptera, especially bees, pollinate Oriental bittersweet flowers. Wind pollination also occurs (fact sheet by [24], review by [170])."
606	2003. Weber, E.. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	[Reproduction by vegetative fragmentation? Yes] "This fast growing vine prolifically sprouts from below-ground rhizomes."

606	2011. Fryer, J.L.. <i>Celastrus orbiculatus</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [Accessed 15 Oct 2013]	[Reproduction by vegetative fragmentation? Yes] "Asexual regeneration is important for Oriental bittersweet spread. Oriental bittersweet sprouts from roots, root fragments, and the root crown [3,26,30,152]."
607	2011. Fryer, J.L.. <i>Celastrus orbiculatus</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [Accessed 15 Oct 2013]	[Minimum generative time (years)? 2] "In the greenhouse, both male and female plants produced flowers in their second year [176]."
701	2011. Fryer, J.L.. <i>Celastrus orbiculatus</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [Accessed 15 Oct 2013]	[Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)? Yes] "Roads may act as corridors for seed dispersal. Oriental bittersweet is common along roadsides [117], especially interstate highways in New England [26]. It has been used in roadside plantings in the Northeast. Humans using fruiting branches for ornaments may disperse seeds when collecting or disposing of the branches [24,26]. People can facilitate animal dispersal of Oriental bittersweet seed by planting Oriental bittersweet as an ornamental [25]." ... "Oriental bittersweet seeds may disperse if these ornaments are discarded on favorable germination sites"
702	2011. Fryer, J.L.. <i>Celastrus orbiculatus</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [Accessed 15 Oct 2013]	[Propagules dispersed intentionally by people? Yes] "In the United States, Oriental bittersweet is commercially available and widely planted and harvested as an ornamental [105]. Wreaths and other ornaments are made from fruiting stems"
703	2008. Smith, C.. <i>Invasive Exotic Plants of North Carolina</i> . N.C. Department of Transportation, Raleigh, NC	[Propagules likely to disperse as a produce contaminant? No. But commercial sale allows for movement of plants and seeds] "Celastrus orbiculatus is still widely sold for floral arrangements and wreaths providing additional avenues for spread and infestation."
704	2011. Fryer, J.L.. <i>Celastrus orbiculatus</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [Accessed 15 Oct 2013]	[Propagules adapted to wind dispersal? No] "Animals, water, and humans disperse Oriental bittersweet seed [26,105,129]. The seed disperses after the 3-valved capsules split open and expose the arils [129]. The brightly colored, fleshy arils attract birds and small mammals, which disperse most of the seed after ingesting the arils [49,96,106,120,143]."
705	2011. Fryer, J.L.. <i>Celastrus orbiculatus</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [Accessed 15 Oct 2013]	[Propagules water dispersed? Yes] "Animals, water, and humans disperse Oriental bittersweet seed [26,105,129]." ... "The fruits can float if they fall into water [105]." ... "Some water-dispersed seed may germinate on floodplains, although seed that floats may be less viable than seed that cannot float. In Connecticut, Oriental bittersweet seed viability was tested for floating vs. sinking seeds. Mean viability was 41% for floating seeds and 88% for sinking seeds [26]."
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] "Seeds are dispersed by birds and mammals. And germinate even in low light."
706	2003. Williams, P.A./Timmins, S.M.. <i>Climbing spindle berry (Celastrus orbiculatus Thunb.) biology, ecology, and impacts in New Zealand</i> . Science for Conservation 234. Department of Conservation, Wellington, New Zealand	[Propagules bird dispersed?] "We found no direct observations of seed dispersal in New Zealand, but the fruit are of a size that could be readily eaten by several small passerines, particularly blackbirds (<i>Turdus merula</i>) and silver eyes (<i>Zosterops lateralis</i>)(Williams & Karl 1996)."
706	2008. Wu, Z.Y./Raven,P.H./Hong, D.Y. (eds.). <i>Flora of China</i> . Vol. 11 (Oxalidaceae through Aceraceae). Science Press & Missouri Botanical Garden Press, Beijing & St. Louis	[Propagules bird dispersed? Yes] "Capsule approximately globose, 8–13 mm wide, yellow, 3-valved. Seeds elliptic, slightly flat, 4–5 × 2.5–3 mm, reddish brown; aril orange-red."

706	2011. Fryer, J.L.. <i>Celastrus orbiculatus</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [Accessed 15 Oct 2013]	[Propagules bird dispersed? Yes] "Frugivorous birds are probably most important for Oriental bittersweet seed dispersal because they are highly mobile, travel in flocks, and often eat "voraciously" [25,49,171]. Northern flickers, yellow rumped warblers, American robins and other thrushes (Turdidae), mockingbirds and catbirds (Mimidae), and European starlings and mynas (Sturnidae) are the primary Oriental bittersweet seed dispersers [171]. In an oak forest in North Carolina, small animals removed 75% of the total Oriental bittersweet seed crop [49]. Near Asheville, North Carolina, birds and small mammals dispersed Oriental bittersweet seeds in "large numbers". Still, more than 80% of Oriental bittersweet arils remained on the parent plant until December, and >50% remained until mid-January [49]. Birds likely disperse Oriental bittersweet seeds where they perch. In central Japan, where Oriental bittersweet is native, Oriental bittersweet seed rain was densest under the liana <i>Smilax china</i> (10 seeds/1.5 m ²) and the shrub <i>Neolitsea sericea</i> (8 seeds/1.5 m ²), both of which were used as bird perches [153]."
707	2011. Fryer, J.L.. <i>Celastrus orbiculatus</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [Accessed 15 Oct 2013]	[Propagules dispersed by other animals (externally)? No. Internally dispersed] "Birds and mammals eat Oriental bittersweet arils. Birds that consume and disperse Oriental bittersweet arils include black capped chickadees, eastern bluebirds, northern mockingbirds, European starlings, blue jays, northern bobwhites, ruffed grouse, ring-necked pheasants, [24,123,150,170], and wild turkeys (Poole 2005 personal communication in [21]). However, it is unclear how important Oriental bittersweet arils are as an avian food source [77]. Frugivorous mammals that eat the arils include fox squirrels and eastern cottontails (review by [170])."
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? Presumably Yes] "Seeds are dispersed by birds and mammals. And germinate even in low light."
708	2011. Fryer, J.L.. <i>Celastrus orbiculatus</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [Accessed 15 Oct 2013]	[Propagules survive passage through the gut? Yes] "Long gut-retention times may result in very long Oriental bittersweet dispersal distances when birds migrate. In Japan, Oriental bittersweet seed remained in the digestive tracts of brown-eared bulbuls (<i>Hypsipetes amaurotis</i> , a native Japanese passerine) for 14 to 42 days (x=27 days). That was one of the longest retention times recorded among 16 bird-dispersed plant species [39]." ... "In a laboratory study, Oriental bittersweet seeds that had either been ingested by birds or had the fruits and arils removed manually showed similar, and higher, germination rates (x=82%) than seeds with intact fruits (x=51%). The authors concluded that although animals aid in seed defleshing and dispersal, gastrointestinal scarification is not needed for germination to occur [48]. Near Asheville, North Carolina, seeds that fell beneath the parent plant, and thus were not ingested by animals, showed reduced germination rates (51%) compared to ingested seeds (82%)."
801	2011. Fryer, J.L.. <i>Celastrus orbiculatus</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [Accessed 15 Oct 2013]	[Prolific seed production (>1000/m ²)? Prolific seeder, but densities in excess of 1000/m ² have not been reported] "Density of Oriental bittersweet seedling recruitment closely matched the density of seeds sown. Seed rain ranged from 14 seeds/m ² to 826 seeds/m ² (x=168 seeds/m ²). Oriental bittersweet seedling emergence from the seed bank averaged 0.9 seedling/m ² . All seedlings emerged in the 1st year of the study, with seedling recruitment ranging from 11 seedlings/m ² to 532 seedlings/m ² (x=107 seedlings/m ²) [30]." ... "In a fact sheet, Dreyer [24] noted that because Oriental bittersweet is such a prolific seed producer, its seed bank is quickly replenished when seed sources remain on site or nearby."
802	2011. Fryer, J.L.. <i>Celastrus orbiculatus</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [Accessed 15 Oct 2013]	[Evidence that a persistent propagule bank is formed (>1 yr)? No] "Oriental bittersweet has a short-lived soil seed bank. Field [29], and laboratory [30] studies suggest Oriental bittersweet seed does not remain viable for more than one growing season, although some managers report that soil-stored Oriental bittersweet seed remains viable for several years [7,24]. The small portion of viable seed remaining in seed banks for more than 1 year contributes little to Oriental bittersweet regeneration [30,78]. A 3-year field study in New Jersey showed a 90% establishment rate of Oriental bittersweet seed the 1st spring after a winter planting. There was no "appreciable" Oriental bittersweet germination in the 2nd or 3rd years of the study [162]. In a 2-year study in an Oriental bittersweet-infested Massachusetts field, Oriental bittersweet seedling recruitment was measured after Oriental bittersweet seed was hand-sown onto study plots. "
803	2003. Weber, E.. <i>Invasive Plant Species of the World. A Reference Guide to Environmental Weeds</i> . CABI Publishing, Wallingford, UK	[Well controlled by herbicides? Yes] "Triclopyr herbicides applied to cut stems is best done late in season when the first frosts appear. Foliar sprays with 2,4-D plus triclopyr are also effective."

803	2011. Fryer, J.L.. <i>Celastrus orbiculatus</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [Accessed 15 Oct 2013]	[Well controlled by herbicides? Yes] "Chemical control: Oriental bittersweet can be controlled with herbicides, using either cut stem or foliar applications. Systemic herbicides (for example, triclopyr or glyphosate) are recommended [24,152]."
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] "Control is difficult because root fragments may produce new plants. Manual control includes regular mowing, cutting and hand pulling."
804	2011. Fryer, J.L.. <i>Celastrus orbiculatus</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [Accessed 15 Oct 2013]	[Tolerates, or benefits from, mutilation, cultivation, or fire? Yes] "Damage to the branches, root crowns, or roots encourages sprouting (fact sheet by [24]). An invasive plant guide reports "vigorous" sprouting after damage to Oriental bittersweet plants [32]. "
805	2011. Fryer, J.L.. <i>Celastrus orbiculatus</i> . In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, http://www.fs.fed.us/database/feis/ [Accessed 15 Oct 2013]	[Effective natural enemies present locally (e.g. introduced biocontrol agents)? Unknown, but unlikely] "As of early 2011, pathogens from Oriental bittersweet's native range had not been approved for use in the United States [24,94,152]. A leaf spot fungus (<i>Marssonina celastris</i>) causes defoliation of Oriental bittersweet in Korea, where Oriental bittersweet is native [142]. Oriental bittersweet has no known pathogens in North America [152]. This may be a factor in Oriental bittersweet's invasiveness in the United States [117]."

Summary of Risk Traits

High Risk / Undesirable Traits

- Temperate vine (marginal in subtropics)
- Broad climate suitability (in temperate areas)
- Widely naturalized
- Forestry weed
- An environmental weed
- With spines
- Potentially allelopathic
- Unpalatable to browsing animals
- Tolerates many soil types
- Shade tolerant
- Overtops & smothers other vegetation & can form thickets in open areas
- Bird and mammal dispersed seeds
- Fruits buoyant & capable of being water-dispersed
- Spreads vegetatively from rhizomes
- Reaches maturity in 2+ years
- Tolerates & resprouts after repeated cutting

Low Risk Traits

- Temperate climate; may only be a threat to higher elevation areas in tropical islands
- Valued as an ornamental
- Not known to form a persistent seed bank
- Herbicides may provide effective control