MN NWAC Risk Assessment Worksheet (04-2011)	Common Name	*Latin Name*
	Oriental Bittersweet Other common names include Round-leaved Bittersweet, Chinese Bittersweet, Asian/Asiatic Bittersweet, climbing spindleberry	***Celastrus orbiculatus* Thunb.**
Reviewer	**Affiliation/Organization**	**Date (mm/dd/yyyy)**
Monika Chandler (2011); James Calkins (2016)	**Minnesota Department of Agriculture; Minnesota Nursery and Landscape Association**	**02/03/2011; 9/29/2016**

Oriental bittersweet (*Celastrus orbiculatus*) is a vigorous, deciduous, woody vine in the bittersweet or staff-tree family (Celastraceae). The leaves are simple, variable, but typically obovate (egg-shaped, broadest toward the tip) to orbicular (rounded), alternately arranged, toothed, and glabrous with distinctly pointed tips. Plants have a rambling (forming tangled thickets) to climbing habit, are relatively fast growing, and climb by twining stems; stems can grow up to 15 feet in a single growing season and can reach lengths of 30 to 60 feet or more. Climbing plants can completely cover and shade out supporting plants including trees and the twining stems can girdle the trunks of trees; the sheer weight of the vines can also result in breakage of the supporting plants. Native to eastern Asia, including Japan and Korea, Oriental bittersweet was introduced to North America as a landscape plant in the mid- to late nineteenth century (1860-1874; references vary) and has since escaped cultivation and become naturalized and sometimes problematic in parts of the eastern United States and Canada. The flowers are small and fairly insignificant, greenish-white, and borne in small axillary cymes in June in Minnesota; plants typically begin to flower at about five years of age, flower on old growth and are insect pollinated (primarily by bees). The flowers are primarily unisexual (male or female), occasionally perfect (making the species polygamo-dioecious), and are generally considered to be functionally dioecious (individual plants male or female); occasional monecious plants have also been reported. The fruits are showy, yellow to orange-yellow, dehiscent, 3-valved capsules that mature in October in Minnesota; each valve contains 1 or 2 seeds covered by fleshy, orange-red arils. Plants prefer and perform best in full sun, but tolerate partial shade and can persist in fairly heavy shade; flowering and fruiting are best in full sun. Planted for its vining habit, attractive foliage, and showy fruits (which are sometimes used in dried

Oriental bittersweet fruits. Leslie J. Mehrhoff, University of Connecticut; Bugwood.org

arrangements), Oriental bittersweet has been occasionally, but not widely, planted in Minnesota. The fruits of Oriental bittersweet are eaten and dispersed by birds. Plants are adaptable and will grow on most soils except those that are poorly drained or permanently wet; moist, well-drained (mesic), acidic soils are preferred, but plants will grow on higher pH soils and established plants are fairly tolerant of dry soils. Oriental bittersweet is reported to be cold hardy to U.S.D.A. Cold Hardiness Zone 4/5 (-20 to -30ºF; -29 to -34ºC/-10 to -20ºF; -23 to -29ºC); although plants have generally performed well in southeastern Minnesota, plants at the Minnesota Landscape Arboretum (Chanhassen, MN; Zone 4b) have historically suffered winter injury and the species may not be reliably hardy north of the Twin Cities. Fall color is yellow. Oriental bittersweet is commercially propagated from semi-hardwood and hardwood stem cuttings, root cuttings, and cleaned (arils removed), stratified (3 months) seed; plants can also be propagated by layering. Related species include American bittersweet (*Celastrus scandens*; hardy to Zone 2, native to eastern and central North America including Minnesota, and the only twining, woody vine that is native to the United States and Canada) and *Euonymus* spp. including the popular shrub *Euonymus alatus* (winged euonymus/spindle tree, burning bush; native to northeastern Asia and extending into central China; fruits small, red to purplish-red; Zone 3). Other non-native species of bittersweet can also be grown in Minnesota, but are very uncommon. Oriental bittersweet is easily confused with American bittersweet and because populations of American bittersweet are declining proper identification is important before initiating control efforts; the leaves of American bittersweet are more elliptic, the fruits tend to be more orange than yellow, and the flowers and fruits are in terminal rather than axillary clusters. In addition, the roots of Oriental bittersweet are bright orange which is a good identifying characteristic.

Oriental Bittersweet Fact Sheet & Regulatory Status in Minnesota: Listed as a Prohibited/Eradicate Noxious Weed in Minnesota; all above and below ground parts of existing plants must be destroyed and the species may not be transported, propagated, or sold in the state; **http://www.mda.state.mn.us/plants/pestmanagement/weedcontrol/noxiouslist/commonbuckthorn.aspx**

Risk Summary (2016): Oriental bittersweet (*Celastrus orbiculatus*) is a non-native woody vine that was introduced in North America from eastern Asia as a landscape plant in the mid-1860s. It has since escaped cultivation and become naturalized and problematic in parts of the eastern United States and Canada. The first confirmed infestations of Oriental bittersweet in Minnesota were confirmed in 2010 by the Minnesota Department of Transportation on highway rights-of-way in the Twin Cities area. It was subsequently determined that these infestations had originated from intentional plantings that had been misidentified as American bittersweet. Oriental bittersweet has since been documented in other areas, but is currently confined to scattered locations in southeastern Minnesota with infestations in Winona (Winona County in southeastern Minnesota) and Elm Creek Park Reserve in Maple Grove (Hennepin County) being two of the largest. Oriental bittersweet was initially listed as a Prohibited/Eradicate Noxious Weed under the Minnesota Noxious Weed Law in 2011.

The distribution of Oriental bittersweet is currently limited to locations in the Minneapolis/St. Paul metropolitan area and other scattered locations in southeastern Minnesota. As a consequence of its relatively limited distribution in the state, it is hoped that eradication of Oriental bittersweet may still be possible and attempts are underway to accomplish this goal. The spread of Oriental bittersweet to new areas is effectively vectored by birds and the species is sometimes found in areas that are difficult to access; these and other factors are of concern and may prove to be significant barriers to a successful eradication effort. A concerted eradication and monitoring effort will be required if the goal of eradication is to be realized.

Box	Question	Answer	Outcome (e.g., Go to Box 7)
1	Is the plant species or genotype non-native?	Yes; Oriental bittersweet is native to eastern Asia in China, Japan, Korea, Mongolia, and Russia (Russian Federation) (Snyder, 2000; Dirr, 1990; Fryer, 2011). It appears Oriental bittersweet was introduced as a landscape plant in Europe in 1859 and in the United States (New York) in 1886 (Del Tredici, 2014). In North America, Oriental bittersweet is currently found in southeastern Canada and in the United States from Maine to Minnesota and south to Louisiana and Georgia (EDDMapS) and has also been reported to be in South Dakota, Nebraska, and Texas (Zaya et al, 2015).	Go to Box 3
2	Does the plant species pose significant human or livestock concerns or have the potential to significantly harm agricultural production?	Perhaps; Oriental bittersweet could have a negative impact on forestry production in southern Minnesota; but most forest production is in northern Minnesota (NBII & IUCN/SSC ISSG, 2005; Ellsworth, Harrington, and Fownes, 2004a).	
	A. Does the plant have toxic qualities that pose a significant risk to livestock, wildlife, or people?	No.	
	B. Does the plant cause significant financial losses associated with decreased yields, reduced quality, or increased production costs?	Perhaps; could impact forestry (NBII & IUCN/SSC ISSG, 2005).	

Box	Question	Answer	Outcome (e.g., Go to Box 7)
3	Is the plant species, or a related species, documented as being a problem elsewhere?	Yes; Oriental bittersweet is widely distributed in the eastern United States and southeastern Canada and is listed as a noxious weed in CT, MA, NH, NC, and VT; has the potential to invade mixed-hardwood and pine forests (especially forest edges and openings) and prairie communities; it is also common along roadsides and disturbed sites caused by a variety of factors (e.g., storm damage, logging, steep slopes, insect and disease infestations, etc.) (Fryer, 2011; Silveri, Dunwiddie, and Michaels, 2001). The US Forest Service has ranked this species as Category 1: highly invasive. Interestingly, the potential for invasiveness was first suggested in 1947 (Fryer, 2011).	Go to Box 6
4	Are the plant's life history & growth requirements sufficiently understood?	Yes; although not as cold hardy, grows in habitats similar to those inhabited by American bittersweet (*Celastrus scandens*); primarily spreads to new areas by seed vectored by frugivorous birds (NBII & IUCN/SSC ISSG, 2005; Fryer, 2011), but also suckers from the roots locally, and has the potential to invade streambanks, forest edges, woodland openings, and open areas (Fryer, 2011).	
5	Gather and evaluate further information:	(Comments/Notes)	
6	Does the plant species have the capacity to establish and survive in Minnesota?	Yes; Oriental bittersweet is hardy to USDA Cold Hardiness Zone 4/5 (Snyder, 2000). Oriental bittersweet is present in Duluth and several southeastern counties including the Twin Cities metropolitan area; as of October 2016, Oriental bittersweet has been reported in 15 of Minnesota's 87 counties (EDDMapS) and there are documented infestations in the Twin Cities and Winona that are many years old.	Go to Box 7
	A. Is the plant, or a close relative, currently established in Minnesota?	Yes; Oriental bittersweet is established in southeastern Minnesota; American bittersweet (*Celastrus americana*) is native to Minnesota.	

Box	Question	Answer	Outcome (e.g., Go to Box 7)
	B. Has the plant become established in areas having a climate and growing conditions similar to those found in Minnesota?	Yes: established in the northeastern United States; also found in Wisconsin and further to the south in Illinois and Iowa.	
7	Does the plant species have the potential to reproduce and spread in Minnesota?	Yes; it has been reported that Oriental bittersweet reproduces by seed, stolons (layers?), rhizomes (unlikely), and root suckers (Fryer, 2011). Consumption of fruit containing seed by birds and other wildlife facilitates spread. Humans can disperse Oriental bittersweet seeds when collecting and transporting the fruiting branches and when the fruiting branches are ultimately discarded.	Go to Box 8
	A. Does the plant reproduce by asexual/vegetative means?	Yes; Oriental bittersweet can reportedly reproduce by stolons (layers?), rhizomes (unlikely), and root suckers (including root pieces) (Fryer, 2011).	Go to Question B
	B. Are the asexual propagules effectively dispersed to new areas?	No; unless the propagules are dispersed by human activities.	Go to Question C
	C. Does the plant produce large amounts of viable, cold-hardy seeds?	Yes; Oriental bittersweet is a prolific seed producer (370 fruits/year; Fryer, 2011) and the seeds are cold hardy (at least in the southern parts of Minnesota). Seed viability in soil is not long (generally 1 year, but a small percentage may survive for a maximum of a few years) resulting in a limited seedbank which has little if any impact on regeneration (Fryer, 2011). Most seedlings result from seed rain and germinate from seeds produced the previous year (Ellsworth, Harrington, and Fownes, 2004b). Seeds require cold stratification to germinate and germination is reduced when arils are still present (Dirr and Heuser, 1987); germination rates of 85-95% are common and seeds will germinate under a wide range of light intensities (Ellsworth, Harrington, and Fownes, 2004a; Fryer, 2011). Drought is often responsible for seedling mortality.	Go to Question F

Box	Question	Answer	Outcome (e.g., Go to Box 7)
	D. If the species produces low numbers of viable seeds, does it have a high level of seed/seedling vigor or do the seeds remain viable for an extended period?		
	E. Is the species self-fertile?	Possibly (one reference); but only to a very limited extent given the primarily dioecious nature of the species.	
	F. Are sexual propagules – viable seeds – effectively dispersed to new areas?	Yes; birds and other wildlife can vector Oriental bittersweet seed dispersal (NBII & IUCN/SSC ISSG, 2005; Fryer, 2011). Establishment along fence lines and other roosting areas is facilitated by birds. Birds known to eat Oriental bittersweet fruits include black-capped chickadees, eastern bluebirds, northern mockingbirds, European starlings, blue jays, northern bobwhites, ruffed grouse, ring-necked pheasants, and wild turkeys and the fruits are also eaten by squirrels and rabbits (Fryer, 2011). Fruits and seeds may also be moved in water (floating seeds may have lower viability) (Fryer, 2011).	Go to Question I
	G. Can the species hybridize with native species (or other introduced species) and produce viable seed and fertile offspring in the absence of human intervention?	Yes; Oriental bittersweet has the potential to hybridize with American bittersweet based on laboratory studies, but the extent of hybridization in the wild is unknown (Pavlovic and Leicht-Young, 2007; Pooler et al, 2002; Dreyer et al, 1987); based on limited data, it has been suggested that hybrids are so far rare and that the pollen flow tends to be unidirectional, but not exclusively, from Oriental bittersweet to American bittersweet and that the resulting hybrids exhibit reduced vigor and seed set (Zay et al, 2015). As a consequence of hybridization and the vigor of Oriental bittersweet and the hybrids, it is possible that the genetic identity of American bittersweet may be threatened (White and Bowden, 1947; Pooler et al, 2002; Zaya, et al, 2015).	

Box	Question	Answer	Outcome (e.g., Go to Box 7)
	H. If the species is woody (trees, shrubs, and woody vines) is the juvenile period less than or equal to 5 years for tree species or 3 years for shrubs and vines?	Yes; typically 2-5 years; flowering and fruiting can be delayed until plants reach the upper canopy in forested situations.	
	I. Do natural controls exist, species native to Minnesota, that are documented to effectively prevent the spread of the plant in question?	No.	Go to Box 8
8	Does the plant species pose significant human or livestock concerns or has the potential to significantly harm agricultural production, native ecosystems, or managed landscapes?	Yes; invasive and harms native ecosystems; see Box 3.	Go to Box 9
	A. Does the plant have toxic qualities, or other detrimental qualities, that pose a significant risk to livestock, wildlife, or people?	No.	Go to Question B
	B. Does, or could, the plant cause significant financial losses associated with decreased yields, reduced crop quality, or increased production costs?	Yes; Oriental bittersweet could cause significant financial losses to the forestry sector.	Go to Box 9

Box	Question	Answer	Outcome (e.g., Go to Box 7)
	C. Can the plant aggressively displace native species through competition (including allelopathic effects)?	Yes; abundant fruit and seed production, high rates of germination and seedling establishment, and tolerance of a wide range of soils and light intensities including shade, vegetative reproductive ability via root suckers, fast growth rate, and its attractiveness to people are reasons why Oriental bittersweet is an effective invader; allelopathic effects have been suggested, but research is limited (Ladwig, et al, 2012; Pisula and Meiners, 2010). Oriental bittersweet infestations may change soil chemistry – a comparison of research plots with and without Oriental bittersweet indicated that plots with Oriental bittersweet had significantly higher soil pH, potassium, calcium, and magnesium levels and had higher nitrogen mineralization and litter decomposition rates than those without Oriental bittersweet (Leicht-Young, O'Donnell, and Silander, 2009). Specific to its native congener, American bittersweet, Oriental bittersweet is more adaptable and prolific; Oriental bittersweet has higher pollen and seed viability, exhibits higher seedling survival rates, produces more aboveground biomass under low light conditions, and produces seed with a higher germination potential than American bittersweet (Van Clef and Stiles, 2001; Leicht-Young, 2007; Dreyer et al, 1987); these characteristics could give Oriental bittersweet a significant competitive advantage over American bittersweet which is in decline in areas infested with Oriental bittersweet.	

Box	Question	Answer	Outcome (e.g., Go to Box 7)
	D. Can the plant hybridize with native species resulting in a modified gene pool and potentially negative impacts on native populations?	Yes; Oriental bittersweet has the potential to hybridize with American bittersweet based on laboratory studies, but the extent of hybridization in the wild is unknown; as a consequence of hybridization and the vigor of Oriental bittersweet and the hybrids, it is possible that the genetic identity of American bittersweet may be threatened (see Box 7, Question G for additional information).	
	E. Does the plant have the potential to change native ecosystems (adds a vegetative layer, affects ground or surface water levels, etc.)?	Yes; can significantly displace native species and can change forest structure. Interestingly, Oriental bittersweet is expanding its range while American bittersweet appears to be in serious decline; one hypothesis for this decline is that Oriental bittersweet is more adaptable than American bittersweet (Leicht-Young, Silander, and Latimer, 2007).	
	F. Does the plant have the potential to introduce or harbor another pest or serve as an alternate host?	No.	
9	Does the plant species have clearly defined benefits that outweigh associated negative impacts?	No; the negative impacts outweigh benefits; has been used to treat rheumatoid arthritis and bacterial infections and studies have suggested antitumor, anti-inflammatory, antioxidant, antibacterial, and insecticidal properties; enzymes produced in the leaves can be used to clot milk and could possibly be used in cheese production (Otani, Iwagaki, and Hosono, 1991).	Go to Box 10

Box	Question	Answer	Outcome (e.g., Go to Box 7)
	A. Is the plant currently being used or produced and/or sold in Minnesota or native to Minnesota?	Yes; Oriental bittersweet is produced and sold by the floriculture and nursery industries (including online sales). The fruiting stems have traditionally been used in flower arrangements. Historically, Oriental bittersweet has been sold as a landscape plant, but few vendors sell Oriental bittersweet plants today; on occasion, it may be mistakenly mixed with nursery stock and labeled as American bittersweet. The sale and movement of Oriental bittersweet has been prohibited in Minnesota since 2011. Birds and other wildlife utilize the fruits as a food source, but the species is obviously not a native food source.	Go to Question B
	B. Is the plant an introduced species and can its spread be effectively and easily prevented or controlled, or its negative impacts minimized through carefully designed and executed management practices?	Yes and No, respectively; Oriental bittersweet is an introduced species, but its spread cannot be effectively and easily prevented due to bird vectored seed dispersal.	Go to Question C
	C. Is the plant native to Minnesota?	No.	Go to Question D
	D. Is a non-invasive, alternative plant material commercially available that could serve the same purpose as the plant of concern?	Yes; American bittersweet (*Celastrus scandens*), native to eastern North America including Minnesota, and several named selections (cultivars) including monecious selections with improved fruiting are sold in the nursery trade.	Go to Box 10
	E. Does the plant benefit Minnesota to a greater extent than the negative impacts identified at Box #8?	No.	
10	Should the plant species be enforced as a noxious weed to prevent introduction &/or dispersal; designate as prohibited or restricted?	Yes.	

Box	Question	Answer	Outcome (e.g., Go to Box 7)
	A. Is the plant currently established in Minnesota?	Yes; there are documented infestations in the Twin Cities area and in other parts of southeastern Minnesota including Redwing, Stillwater, and Winona; Elm Creek Park Reserve in Maple Grove (Hennepin County) has one of the largest reported populations in the Twin Cities area.	Go to Question B
	B. Does the plant pose a serious human health threat?	No.	Go to Question C
	C. Can the plant be reliably eradicated (entire plant) or controlled (top growth only to prevent pollen dispersal and seed production as appropriate) on a statewide basis using existing practices and available resources?	Perhaps; Oriental bittersweet can be controlled with existing mechanical and chemical methods and it may be possible to eradicate the known infestations. It is, however, likely there are additional infestations in Minnesota that have not yet been documented. If the answer to Question C is "Yes" Monika Chandler and Emilie Justin (Minnesota Department of Agriculture, Noxious and Invasive Weeds and Biological Control Programs) have been overseeing the Oriental bittersweet control efforts in Minnesota and believe eradication of Oriental bittersweet is possible and reasonable (personal communication). If the answer to Question C is "No"	List Oriental bittersweet as a Prohibited/Eradicate Noxious Weed if eradication is believed to be possible and reasonable or as a Prohibited/Control Noxious Weed if eradication is not believed to be possible or reasonable. List Oriental bittersweet as a Restricted Noxious Weed.
11	Should the plant species be allowed in Minnesota via a species-specific management plan; designate as specially regulated?		

Results of Risk Assessment Outcomes		
Review Entity	**Comments**	**Outcome**
NWAC Listing Subcommittee	**2011** - The consensus of the NWAC Listing Subcommittee was to recommend listing Oriental bittersweet as a Prohibited/Eradicate Noxious Weed.	In 2011, the Listing Subcommittee's recommendation to list Oriental bittersweet was forwarded to the full NWAC for approval.
	2016 - When reassessed in 2016, the Listing Subcommittee agreed that Oriental bittersweet should remain listed as a Prohibited/Eradicate Noxious Weed.	As a consequence of the 2016 reassessment, the Listing Subcommittee's recommendation to keep Oriental bittersweet on the Prohibited/Eradicate list was forwarded to the full NWAC for approval.
NWAC Full Group	**2011** - The Oriental bittersweet risk assessment was first presented to the full NWAC by Monika Chandler on February 2, 2011, with the recommendation to list Oriental bittersweet as a Prohibited/Eradicate Noxious Weed.	Based on the initial 2011 risk assessment, the NWAC unanimously approved listing Oriental bittersweet as a Prohibited/Eradicate Noxious Weed on February 2, 2011.
	2016 - The full committee voted to recommend continued regulation of Oriental bittersweet as a Prohibited/Eradicate Noxious Weed (Vote 14 – 0).	RECOMMENDATION: Continue Listing as a Prohibited-Eradicate Species.
MDA Commissioner	**2011** - The NWAC's initial recommendation to list Oriental bittersweet as a Prohibited/ Eradicate Noxious Weed was forwarded to the Minnesota Commissioner of Agriculture on February 3, 2011.	The Minnesota Commissioner of Agriculture approved the listing of Oriental bittersweet as a Prohibited/Eradicate Noxious Weed on March 3, 2011.
	2017 – The commissioner accepted NWAC's recommendation to continue listing as a Prohibited-Eradicate Species (02/06/17)	**PROHIBITED NOXIOUS WEED – ERADICATE LIST**
	FILE #: **MDARA00001OB_02_03_2011**	

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(List any literature, websites, and other publications)

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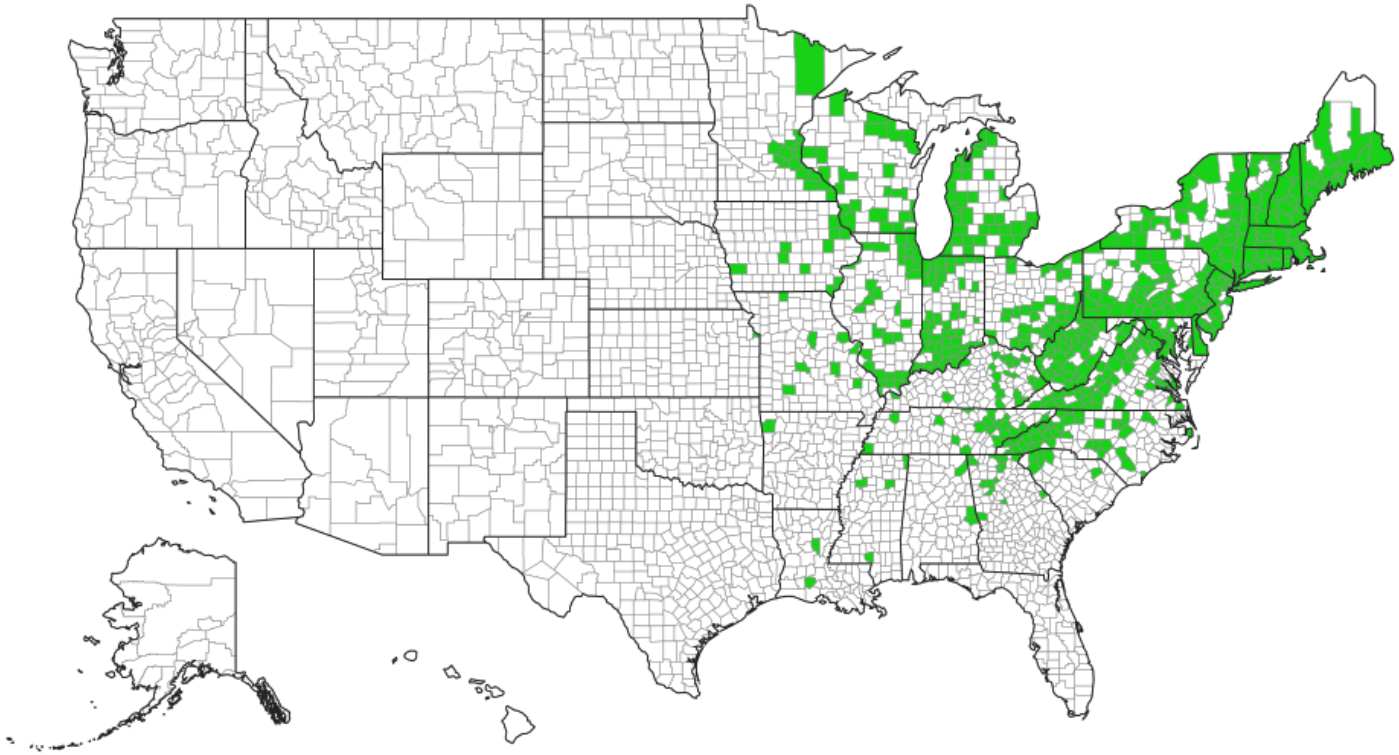

Early Detection & Distribution Mapping System (EDDMapS); https://www.eddmaps.org/distribution/uscounty.cfm?sub=3012 (U.S.A. counties; in MN St. Louis County = Duluth) (Accessed August 5, 2016); specific reported locations in the U.S.A. and Canada available at https://www.eddmaps.org/distribution/viewmap.cfm?sub=3012