

# Minnesota Noxious Weed Risk Assessment

Developed by the Minnesota Noxious Weed Advisory Committee

## Assessment information

**Common name:** Round leaf bittersweet, formerly oriental bittersweet

**Scientific name:** *Celastrus orbiculatus*

**Family name:** Celastraceae

Current reviewer name and organizational affiliation: Emilie Justen, Minnesota Department of Agriculture

Date of current review: 07/12/2022

Previous reviewer name and organizational affiliation: James Calkins, Minnesota Nursery and Landscape Association

Date of previous review: 9/29/2016

Previous reviewer name and organizational affiliation: Monika Chandler, Minnesota Department of Agriculture

Date of previous review: 2/3/2011

## Species description

### Photos



Photo caption: Red fruit and yellow capsules. Photo credit: Minnesota Department of Agriculture



Photo caption: Vine girdling a tree. Photo credit: Minnesota Department of Agriculture

### Why the plant is being assessed

- This species is being re-reviewed as part of the listing process for species on the noxious weed list.
- It has been extensively mapped since 2016 and current distribution has been delimited.
- Ongoing management efforts in densest infestations have given insight to feasibility of eradication on statewide level.
- As of 22 April 2022, Minnesota has approximately 3,640 infested acres with 2,218 locations.

### Identification, biology, and life cycle

- Woody vine that wraps around structures, trees, and shrubs, strangling trees and other vegetation.
- Fruit is bright red with yellow capsules; prolific seed producer.
- Fruit is consumed by birds and other animals which spread the seed.
- Looks similar to the native American bittersweet (*Celastrus scandens*).
- The [Minnesota](#) Department of Agriculture Oriental bittersweet species page and the [Minnesota](#) Department of Natural Resources Oriental bittersweet species page provide additional descriptions and photos (Minnesota Department of Agriculture 2022, Minnesota Department of Natural Resources 2022).

## Current distribution

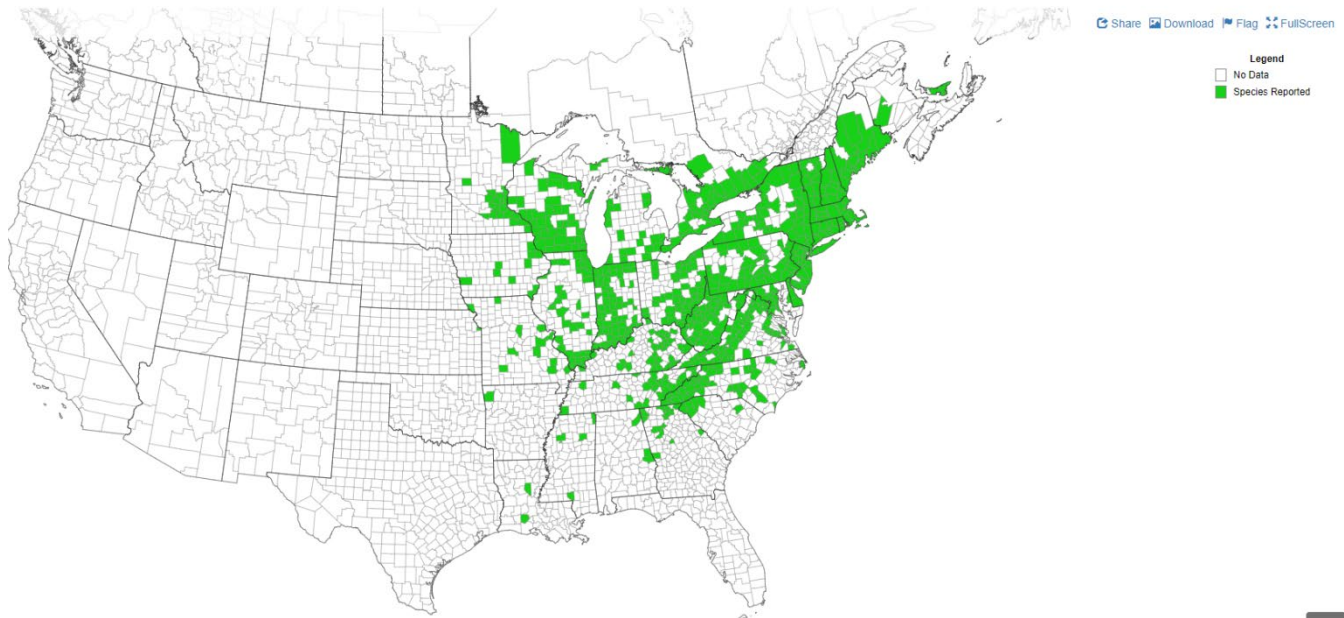


Photo caption: National level map from USDA Plants or EDDMapS. Accessed 22 April 2022. Plant is found in counties from the East Coast to Minnesota and south through Louisiana.

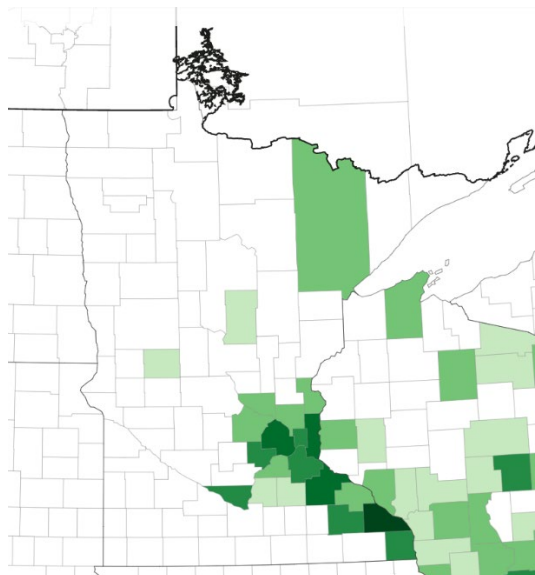


Photo caption: State level map from EDDMapS. Accessed 22 April 2022. Oriental bittersweet is found in most counties in Eastern Minnesota and the counties are shaded from light green, indicating less density, to dark green, indicating more density.

## Current regulation

Oriental bittersweet is currently regulated in Minnesota as a Prohibited-Eradicate Noxious Weed. It is prohibited from sale in Connecticut, Indiana, Iowa, Maine, New Hampshire, North Carolina, Ohio, Vermont, Virginia, and Wisconsin.

## Risk assessment

### Box 1:

#### Is the plant species or genotype non-native?

Answer: Yes

Outcome: Go to Box 3

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 2022) and has also been reported to be in South Dakota, Nebraska, and Texas (Zaya et al. 2015).

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### Box 2:

#### Does the species pose significant human or livestock concerns or have the potential to significantly harm agricultural production?

*Question 2A: Does the plant have toxic qualities that pose a significant risk to livestock, wildlife, or people?*

Outcome: Decision tree does not direct to this question.

*Question 2B: Does the plant cause significant financial losses associated with decreased yields, reduced quality, or increased production costs?*

Outcome: Decision tree does not direct to this question.

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### Box 3:

#### Is the species, or a related species, documented as being a problem elsewhere?

Answer: Yes

Outcome: Go to Box 6

Oriental bittersweet is widely distributed in the eastern United States and southeastern Canada and is listed as a noxious weed in Connecticut, Massachusetts, New Hampshire, North Carolina, and Vermont. It 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 et al. 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). Steward et al. (2003) has documented populations of *C. orbiculatus* increasing while populations of *C. scandens* decreasing.

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### Box 4:

#### Are the species' life history and growth requirements understood?

Outcome: Decision tree does not direct to this question.

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**Box 5:****Gather and evaluate further information**

Outcome: Decision tree does not direct to this question.

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**Box 6:****Does the species have the capacity to establish and survive in Minnesota?**

*Question 6A: Is the plant, or a close relative, currently established in Minnesota?*

Answer: Yes

Outcome: Go to Box 7

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 May 2022, Oriental bittersweet has been reported in 20 of Minnesota's 87 counties (EDDMapS 2022) and there are documented infestations in the Twin Cities and Winona that are decades old.

*Question 6B: Has the plant become established in areas having a climate and growing conditions similar to those found in Minnesota?*

Outcome: Decision tree does not direct to this question.

*Question 6C: Has the plant become established in areas having a climate and growing conditions similar to those projected to be present in Minnesota under future climate projections?*

Outcome: Decision tree does not direct to this question.

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**Box 7:****Does the species have the potential to reproduce and spread in Minnesota?**

*Question 7A: Are there cultivars of the plant that are known to differ in reproductive properties from the species?*

Answer: Unknown

Outcome: Go to Question 7B and follow the questions and also answer Question 7J

*Question 7B: Does the plant reproduce by asexual/vegetative means?*

Answer: Yes

Outcome: Go to Question 7C

Oriental bittersweet can reportedly reproduce by rhizomes or root suckers (Ichihashi and Tateno 2011), adventitious roots, aerial stems, and basal buds (McKenzie-Gopsill and MacDonald 2021, Fryer 2011, Pavlovic et al. 2016). Pavlovic et al. (2016) found that burning Oriental bittersweet increased stem density.

*Question 7C: Are the asexual propagules - vegetative parts having the capacity to develop into new plants - effectively dispersed to new areas?*

Answer: No

Outcome: Go to Question 7D

Dispersal is unlikely unless the propagules are dispersed by human activities.

*Question 7D: Does the plant produce large amounts of viable, cold hardy seeds? For woody species, document the average age the species produces viable seed.*

Answer: Yes

Outcome: Go to Question 7G

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 et al. 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 et al. 2004a, Fryer 2011). Drought is often responsible for seedling mortality.

*Question 7E: For species that produce low numbers of viable seeds, do they have a high level of seed/seedling vigor or remain viable for an extended period (seed bank)?*

Outcome: Decision tree does not direct to this question.

*Question 7F: Is the plant self-fertile?*

Outcome: Decision tree does not direct to this question.

*Question 7G: Are sexual propagules – viable seeds – effectively dispersed to new areas? List and consider all vectors.*

Answer: Yes

Outcome: Go to Question 7I

It has been reported that Oriental bittersweet reproduces by seed and root suckers (Fryer 2011). Consumption of fruit containing seed by birds and other wildlife facilitates spread (LaFleur et al. 2009). Humans can disperse Oriental bittersweet seeds when collecting and transporting the fruiting branches and when the fruiting branches are ultimately discarded.

Birds and other wildlife can vector Oriental bittersweet seed dispersal (NBII & IUCN/SSC ISSG 2005, Fryer 2011, LaFleur et al. 2009). 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).

*Question 7H: Can the species hybridize with native species (or other introduced species) and produce viable seed and fertile offspring in the absence of human intervention?*

Answer: Yes. ***This information is supplemental and is not part of the flow chart pathway for this risk assessment.***

Oriental bittersweet has the potential to hybridize with American bittersweet (*C. scandens*) based on laboratory studies, but the extent of hybridization in the wild was unknown in 2016 (Leicht-Young et al. 2007a, Dreyer et al. 1987).

In 2021, Zaya et al published results from a study showing that *C. orbiculatus* “has a significant advantage in male and female fecundity compared to the native *C. scandens*.” Oriental bittersweet begins flowering earlier than American bittersweet and Oriental bittersweet produces hundreds more flowers per staminate plant than the native, giving Oriental bittersweet “an extreme advantage in male floral production” (Zaya et al 2021). Oriental bittersweet also has 65 times more flowers per female plant than the native, giving it an advantage in female floral production (Zaya et al 2021). Zaya et al.’s (2021) study confirmed their hypothesis “that reproductive interference of *C. scandens* occurs in the presence of *C. orbiculatus*”.

*Question 7I: Do natural controls, species native to Minnesota, which have been documented to effectively prevent the spread of the species in question?*

Answer: No

Outcome: Go to Box 8

*Question 7J: Was the answer to Question 7A (Are there cultivars that differ in reproductive properties from the original species) “Yes”?*

Answer: Unknown

Outcome: Information about the reproductive properties of cultivars is not available. Zaya (2013) states that the named varieties ‘Diana’, ‘Hercules’, ‘Indian Brave’, ‘Indian Maiden’ and ‘Indian Mix’ had identical genotypes. Berigen et al. (2017) stated that gardeners are advised to plant male and female cultivars side by side for better fruiting.

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## Box 8:

**Does the species pose significant human or livestock concerns or have the potential to significantly harm agricultural production, native ecosystems, or managed landscapes?**

*Question 8A: Does the plant have toxic qualities, or other detrimental qualities, that pose a significant risk to livestock, wildlife, or people?*

Answer: No

Outcome: Question 8B

No reference to human toxicity or toxicity to livestock or wildlife was found.

*Question 8B: Does, or could, the plant cause significant financial losses associated with decreased yields, reduced crop quality, or increased production costs?*

Answer: Yes

Outcome: Go to Box 9

Oriental bittersweet could cause significant financial losses to the forestry sector. Oriental bittersweet girdles trees which causes trunk failures, and once in the canopy, Oriental bittersweet casts dense shade and the added weight causes limb breakage (Delisle and Parshall 2018).

*Question 8C: Can the plant aggressively displace native species through competition (including allelopathic effects)?*

Answer: Yes. **This information is supplemental and is not part of the flow chart pathway for this risk assessment.**

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 et al 2009, Leicht-Young et al 2015). 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 et al. 2007b, Dreyer et al. 1987, Zaya et al. 2021). These characteristics could give Oriental bittersweet a significant competitive advantage over American bittersweet which is in decline in areas infested with Oriental bittersweet.

*Question 8D: Can the plant hybridize with native species resulting in a modified gene pool and potentially negative impacts on native populations?*

Answer: Yes. ***This information is supplemental and is not part of the flow chart pathway for this risk assessment.***

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).

*Question 8E: Does the plant have the potential to change native ecosystems (adds a vegetative layer, affects ground or surface water levels, etc.)?*

Answer: Yes. ***This information is supplemental and is not part of the flow chart pathway for this risk assessment.***

Oriental bittersweet 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 et al. 2007a, Leicht-Young et al. 2007b).

*Question 8F: Does the plant have the potential to introduce or harbor another pest or serve as an alternate host?*

Answer: Yes. ***This information is supplemental and is not part of the flow chart pathway for this risk assessment.***

Oriental bittersweet has been documented as a host for spotted lanternfly (*Lycorma delicatula*), a phloem-feeding insect that threatens agricultural commodities such as grape, timber, landscape trees, and fruit trees (Murman et al. 2020, Urban 2020, Francese et al. 2020). Impacts of spotted lanternfly include heavy feeding that causes branch dieback or flagging; honeydew secretion which promotes the growth of sooty mold; and the insects themselves becoming a nuisance by swarming in massive numbers (Murman 2020, Tedders and Smith 1976). In one study, Oriental bittersweet was one of eight species that supported spotted lanternfly development from first instar to adult (Murman et al. 2020).

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**Box 9:****Does the species have clearly defined benefits that outweigh associated negative impacts?**

*Question 9A: Is the plant currently being used or produced and/or sold in Minnesota or native to Minnesota?*

Answer: No

Outcome: Box 10

The sale and movement of Oriental bittersweet has been prohibited since 2011.

*Question 9B: 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?*

Outcome: Decision tree does not direct to this question.

*Question 9C: Is the plant native to Minnesota?*

Outcome: Decision tree does not direct to this question.

*Question 9D: Is a non-invasive, alternative plant material or cultivar commercially available that could serve the same purpose as the plant of concern?*

Outcome: Decision tree does not direct to this question.

*Question 9E: Does the plant benefit Minnesota to a greater extent than the negative impacts identified at Box #8?*

Outcome: Decision tree does not direct to this question.

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**Box 10:****Should the species be regulated as Prohibited/Eradicate, Prohibited/Control, or Restricted Noxious Weed?**

*Question 10A: Is the plant currently established in Minnesota?*

Answer: Yes

Outcome: Go to Question 10D

Infestations are documented in the Twin Cities metro area, southeastern Minnesota, Stillwater, Duluth, and a few other outlying counties.

*Question 10B: Would prohibiting this species in trade prevent the likelihood of introduction and/or establishment?*

Outcome: Decision tree does not direct to this question.

*Question 10C: Does this risk assessment support this species being a top priority for statewide eradication if found in the state?*

Outcome: Decision tree does not direct to this question.

*Question 10D: Does the plant pose a serious human health threat?*

Answer: No

Outcome: Question 10F

No documentation found of toxicity if ingested or toxicity to skin.

*Question 10E: Is the health threat posed by the plant serious enough, and is the plant distribution sufficiently small enough to be manageable, and are management tools available and effective enough to justify listing as Prohibited / Eradicate species?*

Outcome: Decision tree does not direct to this question.

*Question 10F: Is the plant known to cause significant ecological or economic harm and can the plant be reliably eradicated (entire plant) on a statewide basis using existing practices and available resources considering the distribution, reproductive biology and potential for spread?*

- *For distribution, note if the distribution is well documented, the number and acreage of known infestations and how widespread they are in the state. Note if there are infestations in border areas.*
- *For reproductive biology, note if there are reproductive biology factor that make the plant easier to control and eradication more likely (for example, long pre-reproductive period, self-incompatible pollination, short-lived seed bank).*
- *For potential for spread and re-invasion of controlled areas, note its potential to spread beyond places where it is being controlled such as deliberate planting by people, wildlife vectors, re-infestation from border states, or other factors that facilitate spread.*
- *For known management tools, note what management tools are available, potential non-target impacts, and the reasonableness of state management or mandating that landowners throughout the state use the management tools to eradicate or control existing plants.*
- *For available resources, consider the capacity of state and local personnel and availability of funding to respond to new and existing infestations.*

Answer: No

Outcome: Go to Question 10G

Since the species was listed, efforts have focused on extensive mapping of the infestations and managing the densest infestations. Infested acres that have been mapped now total over 3,600 acres, which is over 6 times the number of infested acres of other eradicate species (EDDMapS 2022). The number of infested acres of Oriental bittersweet is more on par with Prohibited-Control species, such as the knotweeds (*Polygonum cuspidatum*, *P. sachalinense*, and *P. x bohemicum*) (959 combined infested acres) or non-native phragmites (*Phragmites australis* ssp. *australis*) (6,268 infested acres).

Furthermore, the available management tools are costly and time consuming. Most of the densest Oriental bittersweet infestations are on steep terrain on private lands, making accessibility difficult. Though cut stump treatments are effective, they are time consuming, with the added challenge of the growth habit of Oriental

bittersweet seedlings creating dense thickets that create a barrier for people to walk through. Forestry mowing can save time but given the steep terrain in many areas, is not always a viable option (Chandler 2022).

The listing subcommittee determined that given the density and number of infested acres, it is not possible to eradicate this species from Minnesota. Oriental bittersweet is likely too widespread for it to continue to be on the Prohibited-Eradicate List. Prohibited-Control is likely the more appropriate category for it to be in. However, because Oriental bittersweet is a woody vine often growing in wooded areas, this may not result in much functional difference for management requirements for landowners with Oriental bittersweet. Prohibited-Eradicate requires that “these species must be eradicated, meaning all of the above and below ground parts of the plant must be destroyed” while Prohibited-Control requires that “efforts must be made to prevent the spread, maturation and dispersal of any propagating parts, thereby reducing established populations and preventing reproduction.” For landowners with mature woody female Oriental bittersweet vines they would need to cut and herbicide vines (or do basal bark herbicide treatments) to follow requirements under either Prohibited-Eradicate or Prohibited-Control. For landowners with male Oriental bittersweet vines they would not be required to do any management of those plants under Prohibited-Control while they would have been required to kill the plants under Prohibited-Eradicate. For landowners with immature Oriental bittersweet growing in a place where mowing is possible, they would have the option of using mowing to prevent seed set as a control measure under Prohibited-Control while mowing is not an acceptable means of control under Prohibited-Eradicate.

*Question 10G: Is the plant known to cause significant ecological or economic harm and can the plant be reliably controlled to limit spread on a statewide basis using existing practices and available resources? Would the economic impacts or other hardships incurred in implementing control measures be reasonable considering any ongoing or potential future increase of ecological or economic harm?*

- Also consider all bullet points listed under 10F when evaluating 10G

Answer: Yes

Outcome: LIST THE PLANT AS A PROHIBITED / CONTROL NOXIOUS WEED

Oriental bittersweet is already prohibited from sale. Moving it from Prohibited-Eradicate to Prohibited-Control allows landowners to focus on cutting vines that produce fruit to prevent the spread of seed. It also remains prohibited from sale and transportation.

Landowners will be required to make efforts to prevent the spread, maturation, and dispersal of any propagating parts to reduce established populations and prevent reproduction and spread. Propagation, sale, or transportation of these plants is prohibited. Management strategies to control Oriental bittersweet include:

- Cutting fruiting vines near the ground and treating the cut stump with a broadleaf herbicide such as triclopyr.
- Forestry mowing infestations and treating any seedlings or regrowth with a broadleaf herbicide such as triclopyr.
- Foliar treating vines with an herbicide.
- Clearing infestations and composting or burning (following local burning permit restrictions) piles, then following up with an herbicide treatment to any seedlings or regrowth.

*Question 10H: Would prohibiting this species in trade have any significant or measurable impact to limit or reduce the existing populations or future spread of the species in Minnesota?*

Outcome: Decision tree does not direct to this question.

Question 10I: Are there any other measures that could be put in place as Special Regulations which could mitigate the impact of the species within Minnesota?

Outcome: Decision tree does not direct to this question.

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#### **Box 11:**

**The species is being proposed to be designated as a Specially Regulated Plant. What are the specific regulations proposed?**

Answer: Decision tree does not direct to this question.

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## **Final outcomes of risk assessment (2022)**

### **NWAC Listing Subcommittee**

Outcome: Change from Prohibited Eradicate to Prohibited Control. (06/17/2022)

Comments: The subcommittee was in agreement about this change.

### **NWAC Full Committee**

Outcome: Change from Prohibited Eradicate to Prohibited Control. (12/13/2022)

Comments: The vote was 16 in favor, 1 against and 1 abstained.

### **MDA Commissioner**

Outcome: Change from Prohibited Eradicate to Prohibited Control.

Comments: No comments

## **Risk Assessment Current Summary (07-12-2022)**

- Oriental bittersweet was added to the Noxious Weed List as a Prohibited Eradicate species in 2011.
- Extensive mapping resulted in the documentation of approximately 3,600 acres in Minnesota.
- Given the extent of the infestation and the challenges of eradication, the listing subcommittee recommends moving *Celastrus orbiculatus* from Prohibited-Eradicate to Prohibited-Control.

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