USDA United States Department of Agriculture

An Assessment of Oriental Bittersweet in Northern U.S. Forests

Research Note NRS-251

This publication is part of a series that provides an overview of the presence of invasive plant species monitored on an extensive systematic network of plots measured by the Forest Inventory and Analysis (FIA) program of the U.S. Forest Service, Northern Research Station (NRS). Each research note features one of the invasive plants monitored on forested plots by NRS FIA in the 24 states of the Midwestern and Northeastern United States.

Background and Characteristics

Oriental bittersweet (*Celastrus orbiculatus*; also known as Asian bittersweet) is a woody vine that is native to China, Korea, and Japan that was introduced as an ornamental around 1860 (Kaufman and Kaufman 2007). The vines can climb into trees where they can girdle stems and branches (Fig. 1). Additionally, the dense growth can shade out vegetation and break stems due to the weight. Birds, small animals, and humans are key vectors related to the spread of this species. Nurseries also aid in its spread. The showy fruit are sold for floral arrangements, crafts, and decor (Fig. 2; Czarapata 2005, Kaufman and Kaufman 2007, Kurtz 2013).

Accurate identification is important as the native American bittersweet (*Celastrus scandens*) closely resembles oriental bittersweet. Some key differences are that the flowers and fruit of American bittersweet occur at the ends of the branches whereas those of oriental bittersweet are at the leaf axil. Additionally the capsule colors differ. Oriental bittersweet has yellow capsules and American bittersweet has orange capsules. Oriental bittersweet has higher shade tolerance (Kaufman and Kaufman 2007).

Description

Growth: large vines can reach over 60 feet in length and over half a foot in diameter; leaves are 2 to 5 inches long, round or oval, simple, alternate, glossy, finely toothed.

Reproduction: almost always dioecious (male and female flowers on separate plants), five petaled flowers in clusters (Fig. 3); green fruits mature to yellow-orange capsules in fall, which open to show red berries.

Habitat: open woodlands, roadsides, urban areas.

Growth conditions: prefers sun to part shade.

Control: various chemical and mechanical methods; repeated monitoring is necessary due to resprouting (Czarapata 2005, Kaufman and Kaufman 2007).

Growth Conditions and Range

Oriental bittersweet is fire tolerant, hardy to -38 °F, requires 100 or more frost free days, and has moderate drought tolerance. It is currently found in 25 states and three Canadian provinces (NRCS 2018).

Figure 1.—Oriental bittersweet girdling a tree. Photo by Leslie J. Mehrhoff, 5487327 from Bugwood.org.

Figure 2.—Dried oriental bittersweet for sale. Photo by Leslie J. Mehrhoff, 5503508 from Bugwood.org

Figure 3.—Oriental bittersweet in flower. Photo by Leslie J. Mehrhoff, 5501274 from Bugwood.org

Oriental Bittersweet Presence on Phase 2 Invasive Plots, 2016

FIA crews visited 4,981 forested Phase 2 (P2) invasive plots across the NRS region for the 2016 inventory. The 2016 inventory encompasses plots measured from 2011 to 2016. These P2 invasive plots are a subset of the standard P2 plots where 40 invasive plant species (IPS[1]) (39 species and one undifferentiated genus [nonnative bush honeysuckle][2]) are monitored. Various attributes are collected including the occurrence and coverage of IPS as well as the standard forest variables measured on P2 plots (e.g., tree diameter, height). Overall, 52.0 percent of forested[3] plots have one or more of the monitored invasives present.

Oriental bittersweet is found throughout most of the region on 241 plots (4.8 percent) across 18 of the 24 NRS states (Fig. 4). Connecticut has the highest percentage of plots with oriental bittersweet (56.0 percent), followed by Rhode Island, where 30.8 percent of plots have oriental bittersweet. Field crews did not observe this IPS on plots in Kansas, Minnesota, Missouri, Nebraska, North Dakota, or South Dakota.

For the 2016 inventory, oriental bittersweet is the eleventh most commonly observed invasive species after multiflora rose (30.5 percent), nonnative bush honeysuckles (19.4 percent), garlic mustard (11.2 percent), Japanese honeysuckle (8.0 percent), autumn olive (7.5 percent), Japanese stiltgrass (7.3 percent), Japanese barberry (7.1 percent), black locust (6.5 percent), common buckthorn (6.4 percent), and reed canarygrass (5.6 percent). Additional information about the invasives monitored and county-level occurrence maps for the NRS region from 2005 through 2010 can be found in Kurtz (2013).

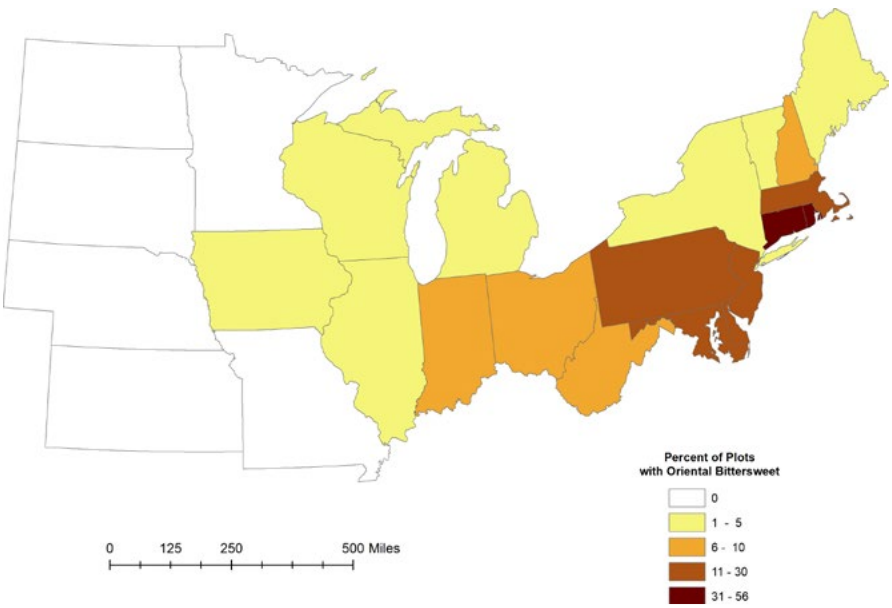

Figure 4.—Percent of Phase 2 invasive plots with oriental bittersweet, 2016. Percentages are rounded to the nearest whole number.

Oriental bittersweet infestation. Photos by Leslie J. Mehrhoff, 5487256 and 5487337 from Bugwood.org.

[1] Hereafter IPS may also be referred to as "invasive species", "invasive plants", or "invasives".

[2] Autumn olive (*Elaeagnus umbellata*), black locust (*Robinia pseudoacacia*), Bohemian knotweed (*Polygonum xbohemicum*), bull thistle (*Cirsium vulgare*), Canada thistle (*Cirsium arvense*), Chinaberry (*Melia azedarach*), common barberry (*Berberis vulgaris*), common buckthorn (*Rhamnus cathartica*), common reed (*Phragmites australis*), creeping jenny (*Lysimachia nummularia*), dames rocket (*Hesperis matronalis*), English ivy (*Hedera helix*), European cranberrybush (*Viburnum opulus*), European privet (*Ligustrum vulgare*), European swallow-wort (*Cynanchum rossicum*), garlic mustard (*Alliaria petiolata*), giant knotweed (*Polygonum sachalinense*), glossy buckthorn (*Frangula alnus*), Japanese barberry (*Berberis thunbergii*), Japanese honeysuckle (*Lonicera japonica*), Japanese knotweed (*Polygonum cuspidatum*), Japanese meadowsweet (*Spiraea japonica*), leafy spurge (*Euphorbia esula*), Louise's swallow-wort (*Cynanchum louiseae*), multiflora rose (*Rosa multiflora*), Japanese stiltgrass (*Microstegium vimineum*), nonnative bush honeysuckle (*Lonicera* spp.), Norway maple (*Acer platanoides*), oriental bittersweet (*Celastrus orbiculatus*), princesstree (*Paulownia tomentosa*), punktree (*Melaleuca quinquenervia*), purple loosestrife (*Lythrum salicaria*), reed canarygrass (*Phalaris arundinacea*), Russian olive (*Elaeagnus angustifolia*), saltcedar (*Tamarix ramosissima*), Siberian elm (*Ulmus pumila*), silktree (*Albizia julibrissin*), spotted knapweed (*Centaurea stoebe* ssp. *micranthos*), tallow tree (*Triadica sebifera*), tree of heaven (*Ailanthus altissima*).

[3] FIA defines forest land as land that is at least 10 percent stocked with trees of any size or land formerly having such tree cover and not currently developed for nonforest use. Generally, the minimum area for classification as a forest is 1 acre in size and at least 120 feet in width. There are more specific criteria for defining forest land near streams, rights-of-way, and shelterbelt strips (USDA Forest Service 2016).

Oriental Bittersweet Cover on Phase 2 Invasive Plots, 2016

The percent cover of oriental bittersweet is shown in two figures, one that illustrates cover by state (Fig. 5) and a second that focuses on plot-level data (Fig. 6). It is important to use caution when looking at Figure 5 because in some states the overall averages are driven by a small number of plots. For the states with a low number of observances, Figure 6 is more informative since individual plot values can be assessed. Iowa is the state with the highest average percent cover of oriental bittersweet on plots (16 percent), however this is based off only two plots (Fig. 6). These maps, along with Figure 4, reveal important information related to the presence and abundance of oriental bittersweet in the NRS region. Over time these maps will allow us to assess changes in abundance and spread throughout this region.

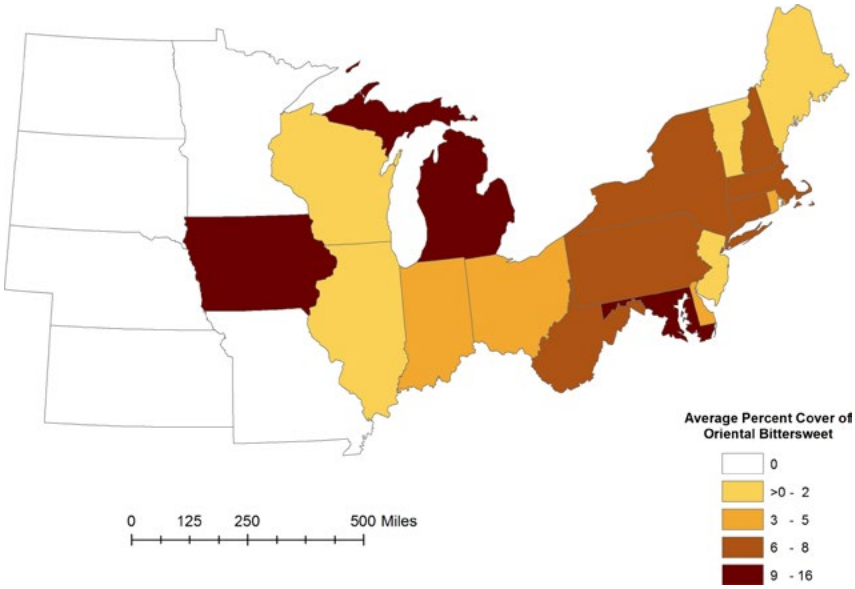

Figure 5.—Average percent cover[4] of oriental bittersweet on Phase 2 invasive plots, 2016. Percentages are rounded to the nearest tenth of a whole number.

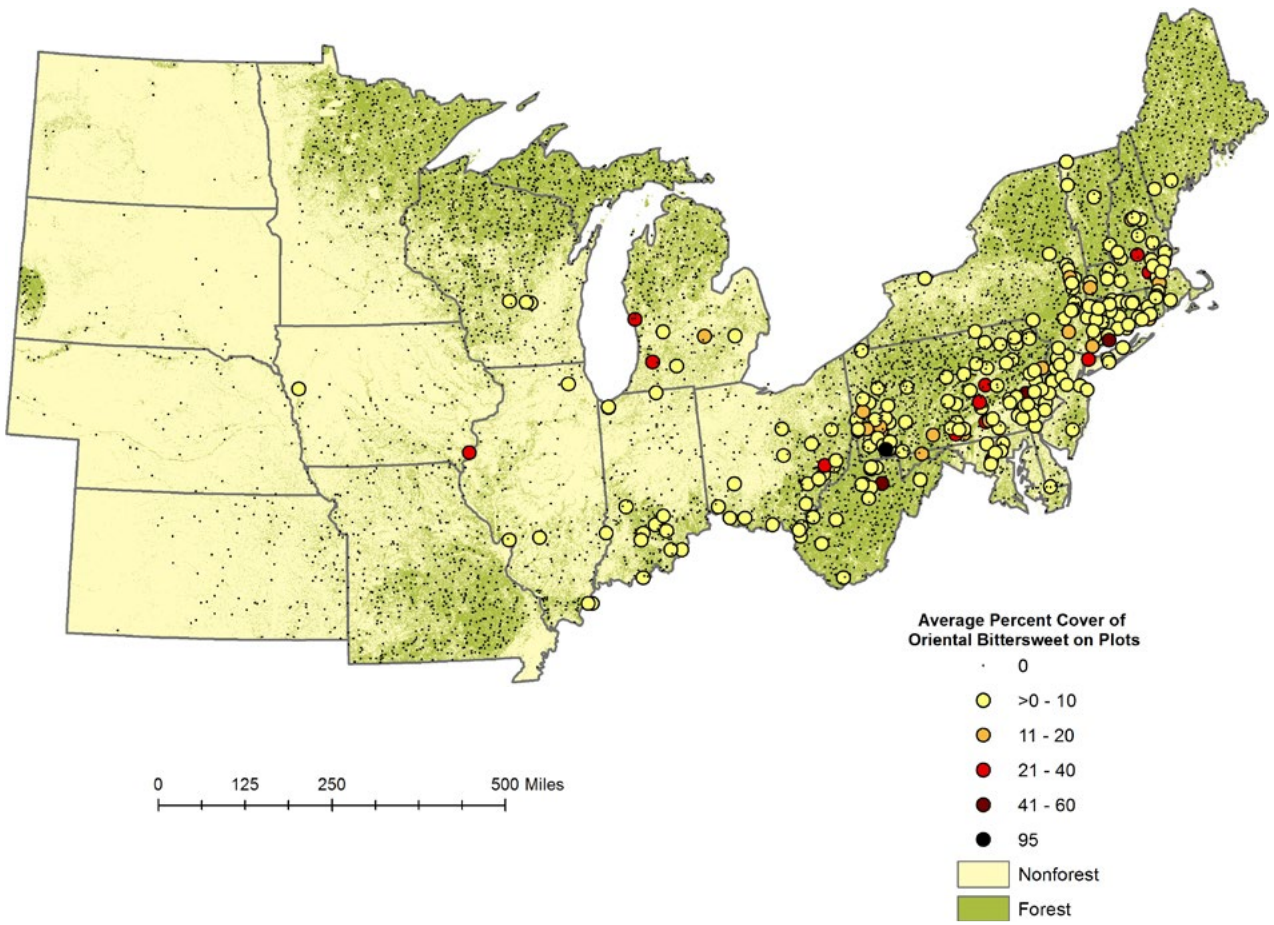

Figure 6.—Average percent cover[4] of oriental bittersweet on Phase 2 invasive plots, 2016. Approximate plot locations depicted. Percentages are rounded to the nearest tenth of a whole number.

[4] Average percentage cover is calculated for plots based on subplot data for the portion of the plot that is forested. Each FIA plot consists of four circular 1/24-acre subplots located at the corners and center of an equilateral triangle that is 208 feet on a side.

Characteristics of Plots with Oriental Bittersweet

Analysis in this section is limited to the 11 NRS states where oriental bittersweet is present on greater than 5 percent of plots, resulting in the analysis of 1,752 plots (35.2 percent of the measured P2 invasive plots in 2016). Of the 1,752 plots, this destructive vine is present on 199. The 11 states in this analysis are Connecticut, Delaware, Indiana, Maryland, Massachusetts, New Hampshire, New Jersey, Ohio, Pennsylvania, Rhode Island, and West Virginia.

Data collected on sample plots suggest that oriental bittersweet is more common on plots near roads (Fig. 7; t-test; $p<0.05$). Several studies have highlighted the effect of roads on invasive distribution (Kurtz and Hansen 2013, Lundgren et al. 2004, Predick and Turner 2008). Roads act as a conduit for seed dispersal and alter light and nutrient availability, as well as drainage. Vehicles traveling on roads carry propagules of many exotics which become dispersed along them. Wildlife, using these roads as corridors, also spread IPS along them.

Plots with oriental bittersweet have fewer seedlings (Fig. 8A; t-test; $p<0.05$) and trees 5 inches diameter at breast height (d.b.h) and greater per acre (8B; t-test; $p<0.05$). Plots with oriental bittersweet are also less forested (Fig. 9; t-test; $p<0.05$). However, there is no significant difference in the number of saplings per acre for plots with or without oriental bittersweet (Fig. 10; t-test; $p>0.05$).

Since the study is relatively new, with complete implementation across all of the NRS region in 2007, it is difficult to assess if the invasives are impacting tree cover or if they are establishing where there are fewer trees and less regeneration. Continued investigation is important because these plants can outcompete native species and without adequate understory regeneration to replace the aging overstory, the future of the forest remains in question. It will be important to continue monitoring how fragmentation and site characteristics affect the presence of oriental bittersweet.

Monitoring IPS offers information on the status, trends, distribution, and population size, and helps to detect new populations. These preliminary investigations are important as they suggest there is a difference between plots with and without Oriental bittersweet and future studies will help determine the effects of these species. IPS can affect property and timber value, biodiversity, habitat quality, and sustainability. Continued monitoring of IPS will help elucidate important factors related to the presence of these invasives as well as to evaluate the impacts of these species on ecosystems.

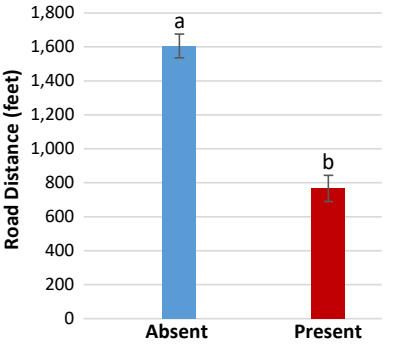

Figure 7.—Average distance to the nearest road for plots where oriental bittersweet is absent or present, 2016.[5]

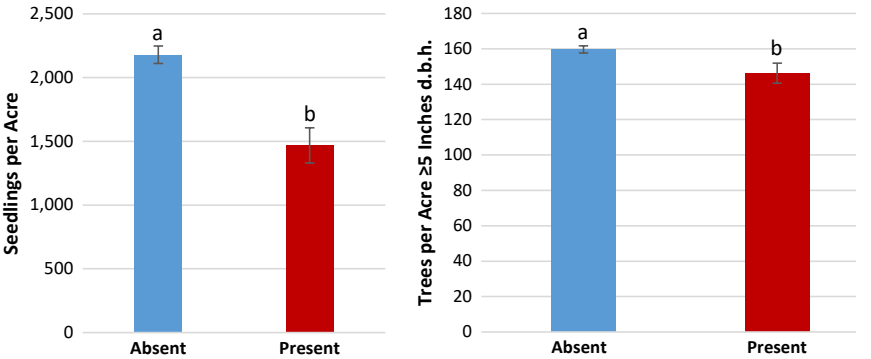

Figure 8.—Number of seedlings (A) and trees ≥5 inches d.b.h. (B) per acre for plots with or without oriental bittersweet, 2016.[5]

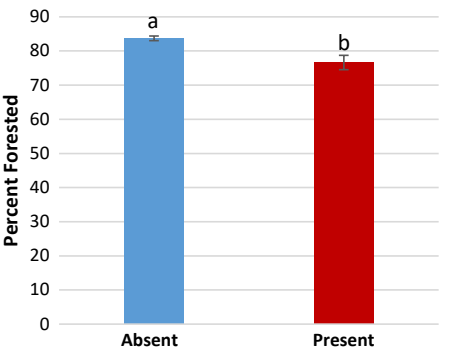

Figure 9.—Percentage of the plot that is forested for plots with or without oriental bittersweet, 2016.[5]

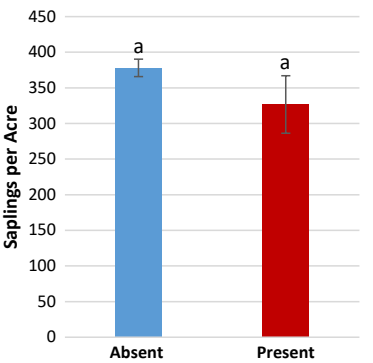

Figure 10.—Number of saplings per acre for plots with or without oriental bittersweet, 2016.[5]

[5] The error bars in Figures 7 through 10 show a 68% confidence interval for the observed mean. Within a figure, statistically significant values are noted by different letters (t-test; $p<0.05$).

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FIA Program Information

Bechtold, W.A.; Patterson, P.L., eds. 2005. **The enhanced Forest Inventory and Analysis Program: national sampling design and estimation procedures.** Gen. Tech. Rep. SRS-80. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 85 p. https://doi.org/10.2737/SRS-GTR-80.

Smith, W.B. 2002. **Forest inventory and analysis: a national inventory and monitoring program.** Environmental Pollution. 116: 233-242. https://doi.org/10.1016/S0269-7491(01)00255-X.

References

Czarapata, E.J. 2005. **Invasive plants of the upper Midwest: an illustrated guide to their identification and control.** Madison, WI: University of Wisconsin Press. 215 p.

Kaufman, S.R.; Kaufman, W. 2007. **Invasive plants: a guide to identification and the impacts and control of common North American species.** Mechanicsburg, PA: Stackpole Books. 458 p.

Kurtz, C.M. 2013. **An assessment of invasive plant species monitored by the Northern Research Station Forest Inventory and Analysis Program, 2005 through 2010.** Gen. Tech. Rep. NRS-109. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 70 p. https://doi.org/10.2737/NRS-GTR-109.

Kurtz, C.M.; Hansen, M.H. 2013. **An assessment of multiflora rose in northern U.S. forests.** Res. Note NRS-182. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 5 p. https://doi.org/10.2737/NRS-RN-182.

Lundgren, M.R.; Small, C.J.; Dreyer, G.D. 2004. **Influence of land use and site characteristics on invasive plant abundance in the Quinebaug Highlands of southern New England.** Northeastern Naturalist. 11(3): 313-332. https://doi.org/10.1656/1092-6194(2004)011%5b0313:IOLUAS%5d2.0.CO;2

Natural Resources Conservation Service [NRCS]. 2018. **The PLANTS database.** Greensboro, NC: U.S. Department of Agriculture, Natural Resources Conservation Service, Plant Data Team. Available at https://plants.usda.gov (accessed May 11, 2018).

Predick, K.I.; Turner, M.G. 2008. **Landscape configuration and flood frequency influence invasive shrubs in floodplain forests of the Wisconsin River (USA).** Journal of Ecology. 96: 91-102. https://doi.org/10.1111/j.1365-2745.2007.01329.x.

USDA Forest Service. 2016. **Forest inventory and analysis national core field guide, vol. 1: field data collection procedures for phase 2 plots, ver. 7.1.** Washington, DC: U.S. Department of Agriculture, Forest Service. www.fia.fs.fed.us/library/field-guides-methods-proc/ (accessed March 22, 2018).

Additional Invasive Plant Information

Invasive and Exotic Plants:
http://www.invasive.org/species/weeds.cfm

Invasive Plant Atlas of New England:
http://www.eddmaps.org/ipane/

Invasive Plant Atlas of the United States:
http://www.invasiveplantatlas.org/index.html

Midwest Invasive Plant Network: http://mipn.org/

Contact

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Page 1 and 5 header: oriental bittersweet fruit. Leslie J. Mehrhoff, University of Connecticut, 5487275 from Bugwood.org.