USDA United States Department of Agriculture

An Assessment of Autumn Olive in Northern U.S. Forests

Research Note NRS-204

This publication is part of a series of research notes that provide an overview of the 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

Autumn olive (*Elaeagnus umbellata*), a shrub of the Oleaster family (Elaeagnaceae), is native to eastern Asia and arrived in the United States in the 1830s. This vigorous invader was promoted for wildlife, landscaping, and erosion control. Tolerant of poor quality sites and full sun, it was often used for mine reclamation. Autumn olive disrupts native plant communities that require infertile soil by changing soil fertility through fixing nitrogen. Where it establishes, it can form dense thickets that shade out native plants (Czarapata 2005, Kaufman and Kaufman 2007, Kurtz 2013). Aside from the negative impact, autumn olive has important culinary and medicinal properties (Fordham et al. 2001, Guo et al. 2009).

Figure 1.—Autumn olive flowers. Photo by Chris Evans, University of Illinois, from Bugwood.org, 1380001.

Description

Growth: woody, perennial shrub to 20 feet, often multi-stemmed; simple, alternate leaves with slightly wavy margins, green upper leaf surfaces, and silvery bottoms; shrubs leaf out early in the spring and retain leaves late in the fall.

Flowers: fragrant, tubular, creamy to light yellow, with 4 petals (Fig. 1); appear singly or in clusters in leaf axils; spring.

Fruit: abundant small (<0.5 inch) green fruits mature to pink/red with silver to coppery spots (Fig. 2); each has one seed; seeds are dispersed by birds and mammals and germinate readily.

Reproduction: seeds; suckers.

Twigs and branches: twigs are silvery to golden brown with a speckled appearance; older branches are gray, often with thorns (Fig. 3).

Habitat: wide variety of habitats with low stocking such as prairies, old fields, open forests, and wastelands; rare in dense forests or on wet sites.

Control: various mechanical and chemical methods; resprouts readily (Czarapata 2005, Kaufman and Kaufman 2007).

Figure 2.—Autumn olive fruit. Photo by Leslie J. Mehrhoff, University of Connecticut, from Bugwood.org, 5455269.

Growth Conditions and Range

Autumn olive has high drought tolerance, is hardy to -23 °F, requires a minimum of 150 frost free days, a pH between 5.0 and 7.5, 28 to 45 inches of precipitation, and a minimum rooting depth of 18 inches. It is currently found in 36 states as well as one Canadian province (Ontario) (NRCS 2016).

Figure 3.—Autumn olive thorns. Photo by James H. Miller, U.S. Forest Service, from Bugwood.org, 0016044.

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Autumn Olive Presence on Phase 2 Invasive Plots, 2014

FIA crews visited 6,360 forested Phase 2 (P2) invasive plots across the NRS region in the 2014 inventory (2009-2014). On P2 invasive plots, 40 invasive plant species[1] (IPS) (39 species and one undifferentiated genus [nonnative bush honeysuckles][2]) are monitored. On each of these plots, various characteristics are recorded including the occurrence and coverage of IPS, as well as the standard forest variables measured on P2 plots (e.g., tree diameter, height). Overall, 50.3 percent of forested plots have one or more of the monitored invasives present.

Autumn olive is widespread throughout the region, occurring on 429 plots (6.7 percent). It is found in 19 of the 24 NRS states (Fig. 4). Field crew did not observe this invasive shrub in Massachusetts, Minnesota, Nebraska, North Dakota, and Rhode Island. These results differ slightly from the Plants Database (NRCS 2016), which reports autumn olive's presence in Nebraska and Rhode Island, but it is important to remember this inventory samples only forest land. West Virginia has 23.2 percent of plots with autumn olive, the greatest percent of all northern states. This invasive shrub is also prevalent in Ohio (19.9 percent of plots), Indiana (17.7 percent of plots), and Illinois (16.0 percent). For the 2014 inventory, autumn olive is the sixth most commonly observed invasive species, after multiflora rose (28.8 percent of P2 invasive plots), nonnative bush honeysuckles (18.4 percent), garlic mustard (9.8 percent), Japanese honeysuckle (7.5 percent), and reed canarygrass (7.4 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).

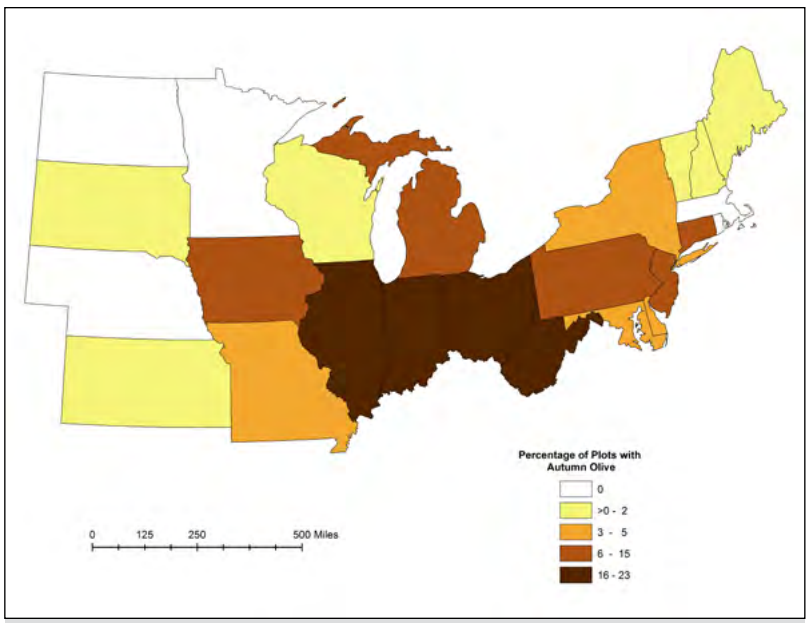

Figure 4.—Percentage of Phase 2 invasive plots with autumn olive, 2014. Percentages are rounded to the nearest whole number.

Autumn olive infestation. Photo by Leslie J. Mehrhoff, University of Connecticut, from Bugwood.org.

[1] 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*), Nepalese browntop (*Microstegium vimineum*), nonnative bush honeysuckles (*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*), Chinese tallow (*Triadica sebifera*), tree of heaven (*Ailanthus altissima*).

[2] The 39 IPS and one undifferentiated genus (nonnative bush honeysuckles) are hereafter referred to as "invasive species", "invasive plants", "invasives", or "IPS".

The percentage cover of autumn olive 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 (e.g., Kansas and South Dakota). For the states with a low number of observances, Figure 6 is more informative since individual plot values can be assessed. Due to the large number of plots monitored, plots without autumn olive are not shown. Autumn olive is most prevalent in the southern part of the region, with the highest average percentage cover on plots in Pennsylvania (6.5 percent). These maps, along with Figure 4, reveal important information related to the presence and abundance of autumn olive in the NRS region. Over time these maps will allow us to assess changes in abundance and spread.

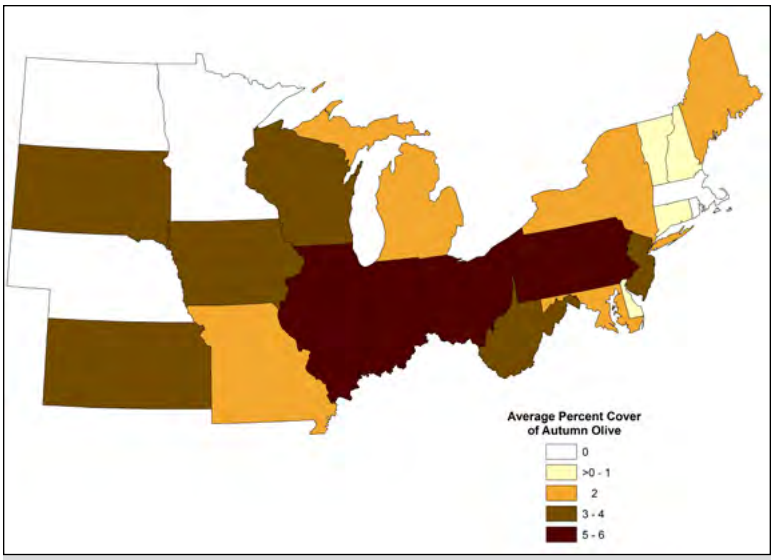

Figure 5.—Average percent cover[3] of autumn olive on Phase 2 invasive plots, 2014. Percentages are rounded to the nearest whole number.

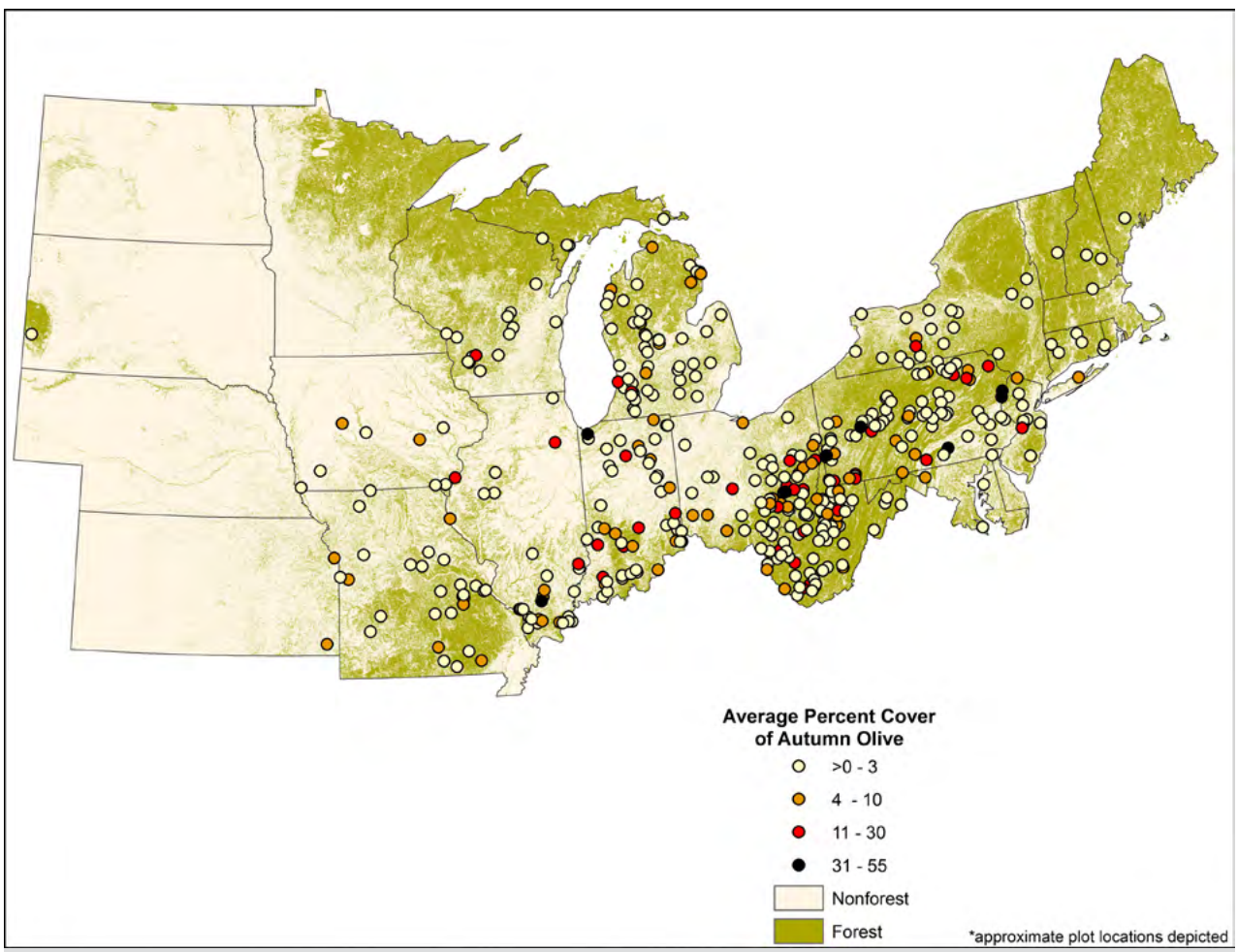

Figure 6.—Average percent cover[3] of autumn olive observances on Phase 2 invasive plots, 2014. Percentages are rounded to the nearest whole number.

[3] Average percent cover is calculated for plots with autumn olive 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 Autumn Olive

The P2 invasive data suggest that autumn olive is more common on plots near roads. There is a significant difference (t-test; $p<0.05$) in the distance to the nearest road for plots with and without autumn olive (Fig. 7). However it is important to note the variability in both road density and autumn olive occurrence across the region before making further conclusions. Several studies have highlighted the effect of roads on invasive distribution. Roads are a conduit for seed dispersal, alter light and nutrient availability, and drainage. Vehicles traveling on roads carry propagules of many exotics which become dispersed along them. Roads are an important vector for IPS (Kurtz and Hansen 2013, Lundgren et al. 2004, Predick and Turner 2008). Due to the effects of roads and other types of fragmentation, it is important to strive to keep forest land intact.

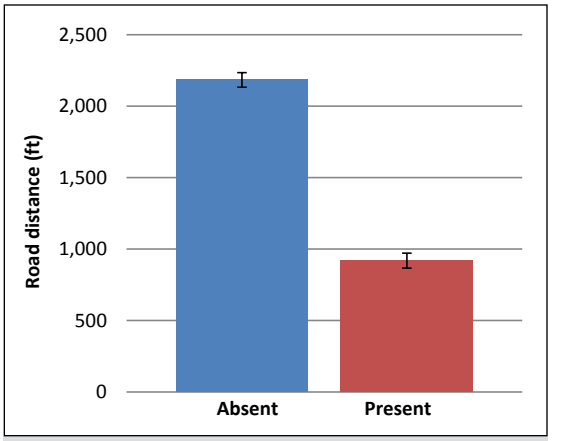

Figure 7.—Average distance to the nearest road for plots with and without autumn olive, 2014. Error bars show a 68 percent confidence interval for the observed mean.

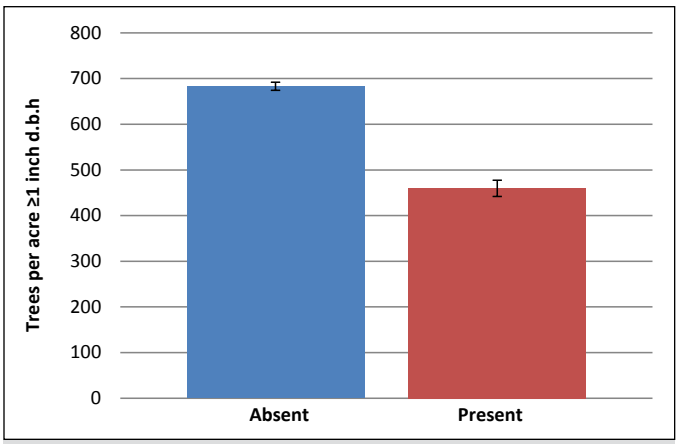

Figure 8.—Trees per acre ≥1 inch d.b.h. with and without autumn olive, 2014. Error bars show a 68 percent confidence interval for the observed mean.

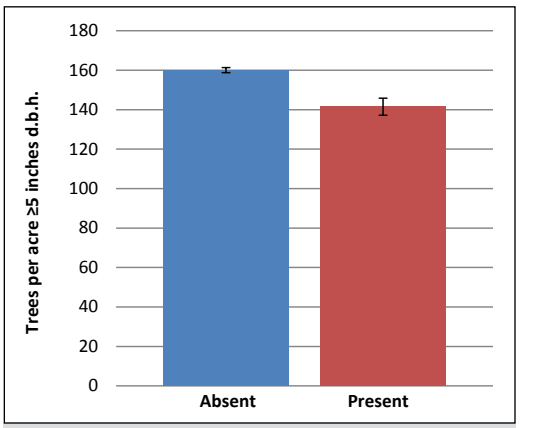

Figure 9.—Trees per acre ≥5 inches d.b.h. with and without autumn olive, 2014. Error bars show a 68 percent confidence interval for the observed mean.

Tree cover also differs for plots with and without autumn olive. The 2014 data suggest that there are fewer trees per acre on plots with autumn olive (Fig. 8 and 9) (t-test; $p<0.05$). Since the study has only been underway for a short time (complete implementation across all of the NRS region in 2007), it is difficult to assess whether the invasives are influencing tree regeneration and growth, or if the IPS are establishing where there is reduced tree cover and less competition. Continued investigation into this matter 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. These preliminary investigations are important as they suggest there is a difference between plots with and without autumn olive.

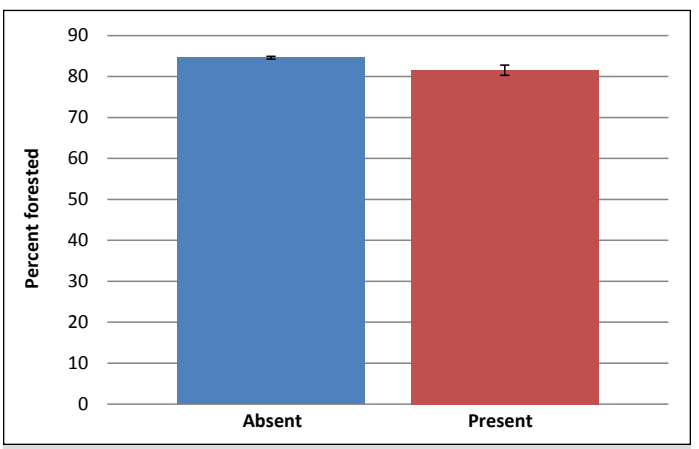

Figure 10.—Percentage of the plot that is forested for plots with and without autumn olive, 2014. Error bars show a 68 percent confidence interval for the observed mean.

Further analysis of plots with and without autumn olive shows that plots without autumn olive tend to be more forested than plots with autumn olive (Fig. 10) (t-test; $p<0.05$). Overall, plots with this invader are 3.0 percent less forested when compared to plots without autumn olive.

Monitoring IPS offers insight on the status, trends, distribution, and population size, as well as helps to detect new populations. The trends found in this research note are important and need to be monitored in the future to help elucidate important factors related to the presence of these invasives as well as to find out the impacts these species are causing on biota and ecosystems. This research is valuable to land managers and other concerned individuals as it provides nonbiased data to help make well-informed management decisions.

Citation for this Publication

Kurtz, Cassandra M.; Hansen, Mark H. 2016. **An assessment of autumn olive in northern U.S. forests.** Res. Note NRS-204. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 5 p.

FIA Program Information

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Additional Invasive Plant Information

Alien Plant Invaders of Natural Areas (PCA, National Park Service): http://www.nps.gov/plants/alien/factmain.htm

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/

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