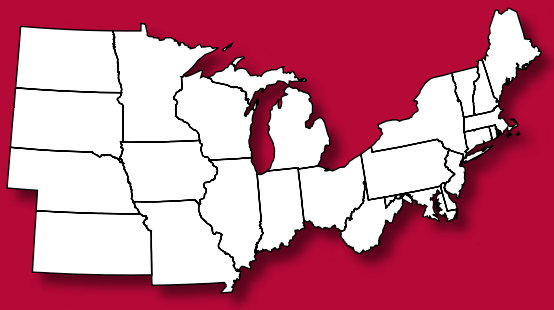
An Assessment of Invasive Plant Species Monitored by the Northern Research Station Forest Inventory and Analysis Program, 2005 through 2010



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NRS-109

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Abstract

Invasive plant species (IPS) are a worldwide concern due to the high ecological and economic costs associated with their presence. These species can displace native fauna and flora and alter ecosystem processes. Despite their negative impacts, these invaders are frequently used for erosion control and site reclamation due to their ability to rapidly colonize an area. These plants also have various herbal and medicinal values. This document describes the plant characteristics and regional distribution of the 50 invasive plant species monitored from 2005 through 2010 on forested Phase 2 (P2) Forest Inventory and Analysis (FIA) plots in the 24 states of the Northern Research Station. Genus level data for nonnative bush honeysuckles (*Lonicera* spp.) are included from 2005 through 2006. The data are from plots that are monitored in forested areas across all ownership classes (public and private).

Acknowledgments

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Cover photos: Japanese knotweed, black locust, spotted knapweed, autumn olive, winter creeper, creeping jenny, glossy buckthorn, common barberry, Morrow's honeysuckle, silktree, tallow tree, princesstree, European cranberrybush, Japanese honeysuckle, Tatarian honeysuckle. See text for photo credits.

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About the Author

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Introduction

The U.S. Forest Service's Forest Inventory and Analysis (FIA) program (Bechtold and Patterson 2005) has been monitoring invasive plant species (IPS) on Phase 2 (P2) invasive plots in the Midwest since 2005 and in the northeastern region of the United States since 2007. The program inventories various forest attributes such as site index, tree volume, and flora which allow for regional resource and trend estimates. From 2005 through 2006, a total of 25 invasive species (Table 1; P2 invasive plots surveyed in 2005-2006 and 2005-2010) were monitored on all forested FIA plots in the Midwest: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, South Dakota, and Wisconsin. The species monitored on the plots were selected based on input from area stakeholders and by evaluating the plants of regional concern. Beginning in 2007, the number of species monitored increased to 43 (Table 1; P2 invasive plots surveyed in 2005-2010 and 2007-2010), and the region was expanded to include all 24 states covered by the FIA program of the Northern Research Station (NRS): Connecticut, Delaware, Illinois, Indiana, Iowa, Kansas, Maine, Maryland, Massachusetts, Michigan, Minnesota, Missouri, Nebraska, New Hampshire, New Jersey, New York, North Dakota, Ohio, Pennsylvania, Rhode Island, South Dakota, Vermont, West Virginia, and Wisconsin. The percentage of plots sampled also changed to approximately 20.0 percent of the forested plots measured by the inventory crews.

In 2007 when the invasive plant inventory was expanded from 11 to 24 states, 7 of the 25 previously-recorded species were no longer monitored (Table 1; P2 invasive plots surveyed in 2005-2006) based on experience gained during the 2005 through 2006 inventories. In addition, the field crews could now indicate the species of nonnative bush honeysuckle (*Lonicera* spp.) encountered on the plot versus solely recording the genus. Table 1 includes the number of plots monitored for each IPS.

To provide a better understanding of the data, a brief overview of the FIA survey plots follows (see Bechtold and Patterson 2005 for more details). Sample plots are randomly located throughout the NRS region. A plot consists of four subplots which total approximately 1/6 acre. The inventory is only conducted on plots that are at least 10.0 percent stocked by trees which cover an area ≥120.0 feet wide for at least 363 feet (total area of 1.0 acre or more). Each P2 plot represents approximately 6,000 acres, and each Phase 3 (P3) plot represents approximately 96,000 acres, except in some states and National Forests where there is a regional intensification of plots. Invasive plant species are measured on a subset of the field plots including the P2 invasive plots, where the IPS of interest are recorded, and the P3 plots, where all plant species (invasives, exotic, and native) are assessed. For this report, in states where both P2 invasive and P3 data were collected, the invasives data from the P3 plots were folded into the P2 invasive plots. When there were no P2 invasive plots for a particular inventory (e.g., Ohio 2005-2006) or species (e.g., English Ivy, *Hedera helix*), the IPS data were calculated solely from P3 plots (Table 1).

The large number of plots monitored for IPS is important as these aggressive plants are a worldwide concern. These species can be costly to manage and impact forest and agricultural productivity. They also impact the habitat and recreation quality. Across the United States, IPS annually harm 3 million acres and cost society $35 billion (Czarapata 2005). From 1985 to 1995, IPS more than quadrupled their impacted region in the Western United States and are annually increasing at 14.0 percent, spreading across Western federal lands at 4,600 acres per day (Czarapata 2005, Kaufman and Kaufman 2007, Westbrooks 1998).

Repeated measurements will help determine factors (e.g., vectors and site characteristics) associated with the presence of these species. Through monitoring the presence and abundance of IPS on NRS FIA plots, we can obtain a better understanding of their regional distribution and abundance. Gathering an understanding of where these species are distributed helps educate individuals of potential risk species across the NRS region.

Figure 1 shows the number of monitored (Table 1) invasive plants species observed on each plot. There is a clear trend of a higher number of invasive plant species per plot in the southeastern part of the region. It is important to note that the maps of this report indicate regional occurrences of the monitored IPS on forested plots from 2005 through 2010 regardless of sampling intensity. To account for sample intensification, the data were normalized at the county level by dividing the number of observations by the total number of plots. Therefore, one must be cautious analyzing the map because when counties with a low number of plots have an invasive plant present, they show a high percentage of invaded plots due to the low sample size.

This document provides a regional overview of IPS monitored on NRS FIA plots and presents the species alphabetically by common name. The objective is to inform citizens about the current status of the selected IPS in forest land across the NRS FIA region through highlighting all observances from 2005 through 2010. Data includes common and scientific name, USDA PLANTS code,

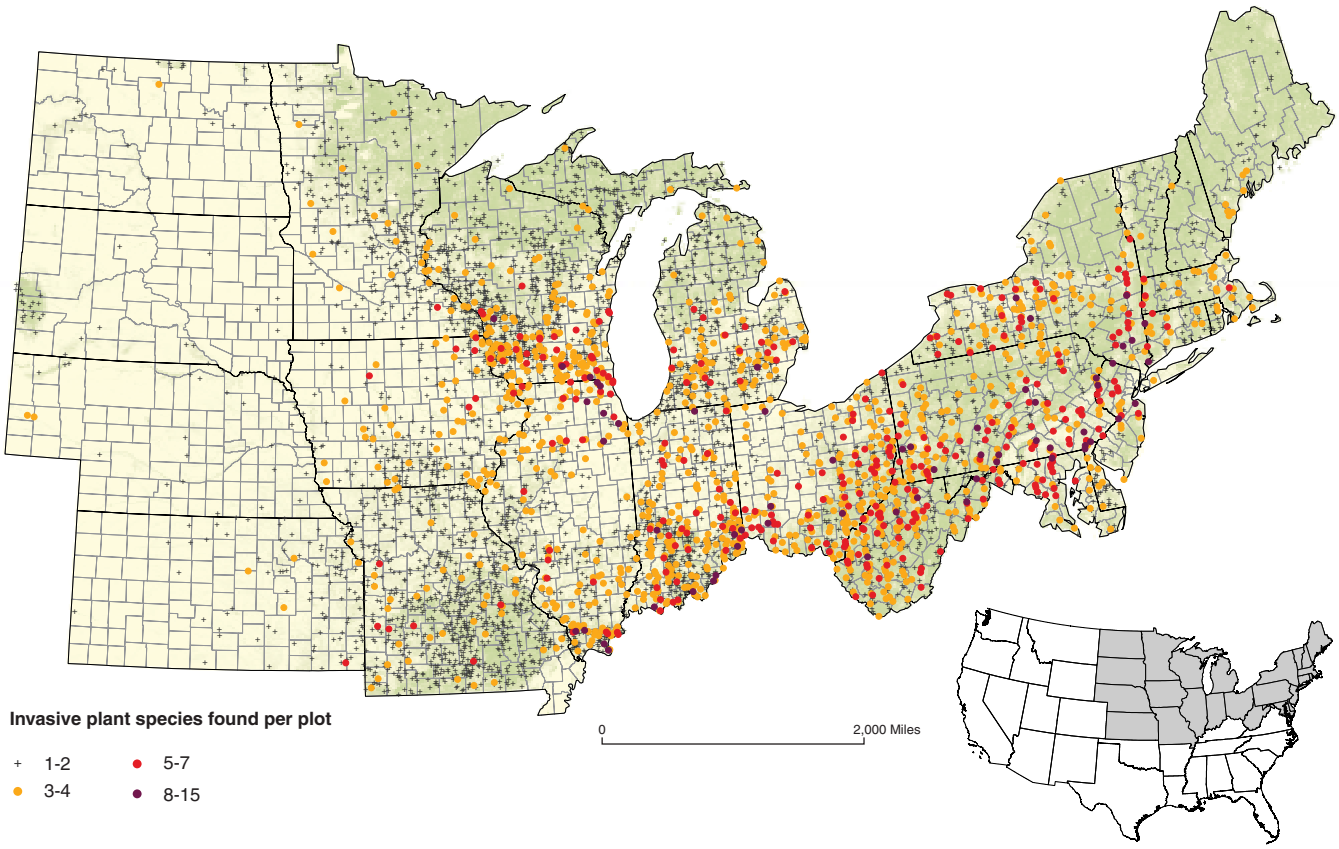

Figure 1.—Number of invasive plant species observed per plot on Forest Inventory and Analysis P2 Invasive plots and P3 plots (2005-2010). Depicted plot locations are approximate.

country or countries of origin, when it was introduced, species characteristics, where the species is currently found, and the results from FIA P2 invasive and P3 monitoring.

The term "constancy" is sometimes included with the P2 invasive and P3 plot results and refers to the proportion of plots where the species is recorded. When applicable, noxious weed designations (restricted, banned, prohibited, and noxious) are included. The definition of these terms follows. Restricted species are commonly observed plants which have detrimental impact and are controlled by prohibiting buying or selling, except by a special permit. Banned species are plants which are illegal to buy or sell. Prohibited species are not present or present in low numbers, cannot be bought or sold, and require removal. Noxious species are those which are considered damaging to property, health, or the environment and can be further categorized by classes ranging from A to C. Those plants classified as Class A noxious weeds are not present or found in limited numbers in a state, Class B are found in moderate numbers, while Class C weeds are commonly found throughout the state. The control of these species ranges from high priority with the Class A weeds to reduced management of Class C weeds, however, control of Class C noxious weeds can be highly enforced dependent on the local threat.

Amur honeysuckle

(Lonicera maackii)
LOMA6

Background and characteristics: Amur honeysuckle, a member of the honeysuckle family (Caprifoliaceae), is native to central and northeastern China, Korea, and Japan and was introduced to the United States in 1898 (Luken and Thieret 1996). This IPS was planted as an ornamental hedge for its aesthetically pleasing flowers (Fig. 2) and fruit. It is an aggressive woody shrub that creates a dense cover which displaces forest understory and impedes regeneration, modifying the forest composition and structure. These shrubs are long-lived, and their spread is facilitated by birds which disperse the fruit across the landscape (Bartuszevige et al. 2007, Luken and Thieret 1996).

Amur honeysuckle is able to grow in varying light levels but will not grow in deep shade, and Luken and Thieret (1996) suggest that within the forest it has minimal carbon gain, resulting in reduced vigor. According to the Plants Database (USDA, NRCS 2012), it is suggested this noxious shrub can survive to -33.0 °F and requires 25.0 to 60.0 inches of precipitation annually, 100 or more frost free days, pH levels between 5.5 and 8.0, and a minimum rooting depth of 16.0 inches. Additional limitations are its intolerance of anaerobic and calcareous soils as well as a cold stratification requirement.

Current distribution: Despite having the preceding site limitations, Amur honeysuckle has spread across the eastern United States, creating nearly impenetrable shrub layers. It is now found in 26 states and classified as invasive in Connecticut, prohibited in Massachusetts, and a Class B noxious weed in Vermont; it is also found in Ontario, Canada (USDA, NRCS 2012).

P2 and P3 monitoring: Amur honeysuckle was monitored on NRS FIA P2 invasive plots from 2007 through 2010 and on P3 plots from 2005 through 2006. It was the 10th most commonly observed IPS, occurring on 217 of 7,107 plots (3.1 percent, Table 2). This shrub ranked among the five most commonly observed IPS monitored on FIA plots in six states (Table 3) of the NRS region: Delaware, Illinois, Iowa, Kansas, Missouri, and Ohio. Regionally the highest percentage of plots with Amur honeysuckle was in Illinois (17.3 percent of forested plots), with Ohio closely following (14.7 percent). Amur honeysuckle was not present in 8 of the 24 states of the NRS FIA region (Fig. 3).

Figure 2.— Large Amur honeysuckle shrub in flower. Photo by Richard Webb, self-employed horticulturist, Bugwood.org.

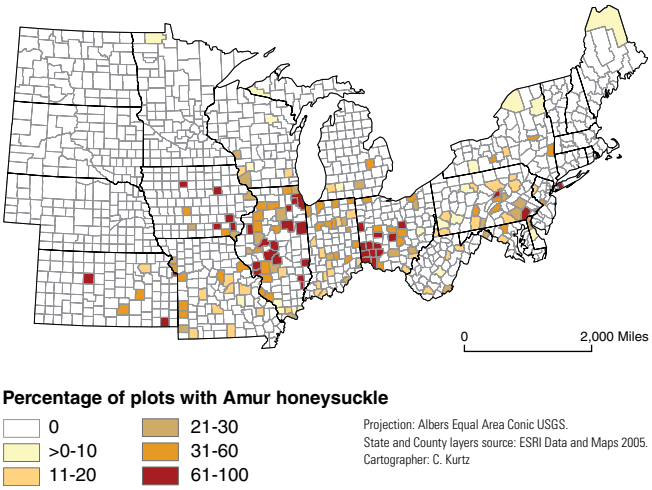

Figure 3.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2007-2010) and P3 plots (2005-2006) where Amur honeysuckle was observed, by county.

Amur peppervine

(Ampelopsis brevipedunculata)
AMBR7

Background and characteristics: Amur peppervine, also known as porcelain berry, is a woody vine of the grape family (Vitaceae) that is native to Russia, China, Korea, and Japan and was introduced to North America as an ornamental near the end of the 19th century (Kaufman and Kaufman 2007). As an ornamental, it is primarily sold in variegated form and offers attractive grape-like foliage and colorful fruits (Fig. 4). Birds and small animals disperse the fruits (Kaufman and Kaufman 2007), facilitating the spread of this IPS.

Growth of Amur peppervine is generally on moist soils in areas of high to moderate light (Boos et al. 2010, Kaufman and Kaufman 2007). Where it establishes, this invasive vine impedes growth by shading out neighboring species, girdling vegetation, and reducing photosynthesis. Amur peppervine can climb up to 20.0 feet (Kaufman and Kaufman 2007). By growing up and over forest vegetation, Amur peppervine creates fuel continuity from the forest floor into the canopy, increasing the fuel load and likelihood of a crown fire (Zouhar et al. 2008).

Current distribution: Amur peppervine is found in 18 eastern states with Connecticut listing it as potentially invasive and Massachusetts as prohibited (USDA, NRCS 2012).

P2 and P3 monitoring: Amur peppervine was monitored on NRS FIA P2 invasive plots from 2005 through 2006 and on P3 plots from 2005 through 2010. It was the 44th most commonly observed IPS, occurring on 2 of 13,659 plots (<0.1 percent; Table 2), and was observed in two states of the NRS FIA region, Ohio and Pennsylvania (Fig. 5).

Figure 4.— Amur peppervine with fruit. Photo by Jil Swearingen, USDI National Park Service, Bugwood.org.

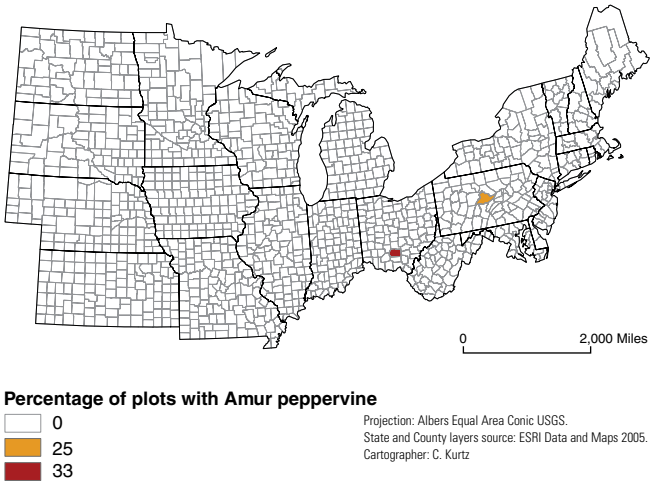

Figure 5.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2005-2006) and P3 plots (2005-2010) where Amur peppervine was observed, by county.

Asiatic tearthumb

(Polygonum perfoliatum* syn. *Persicaria perfoliata)
POPE10

Background and characteristics: Asiatic tearthumb, also known as mile-a-minute vine, Devil's tail, tearthumb, Gangbangui, and Devil shield, is an annual vine of the buckwheat family (Polygonaceae). This invader is native to India, China, Japan, and east Asia and was brought to Portland, Oregon by ship ballast in 1890, but it was not until the late 1930s when seeds came into a Pennsylvania nursery shipment of rhododendrons that this IPS began to escape and establish naturalized populations (Kaufman and Kaufman 2007).

Frequently found growing in moist areas, such as along streams, water is an important vector. Animals are another vector of the fruit and contribute to the spread of this invasive vine (Kaufman and Kaufman 2007). Asiatic tearthumb is found mainly in the mid-Atlantic and northeastern United States in sun to part shade, grows at a rate of up to 6.0 inches per day, and can reach up to 15.0 feet long (Kaufman and Kaufman 2007). The growth of this IPS (Fig. 6) is detrimental to the forest as it grows up vegetation and across the forest floor, impeding photosynthesis of other plant species. The specific growth requirements of this vine restrict its presence. Seeds of Asiatic tearthumb require about 2 months of temperatures below 46.0 °F to germinate (Kaufman and Kaufman 2007).

Current distribution: Asiatic tearthumb is recorded in nine states and is listed as noxious, banned, prohibited, or a plant pest in the following seven states: Alabama, Connecticut, Massachusetts, North Carolina, Ohio, Pennsylvania, and South Carolina (USDA, NRCS 2012).

P2 and P3 monitoring: Asiatic tearthumb was monitored on NRS FIA P2 invasive plots from 2005 through 2006 and on P3 plots from 2005 through 2010. It was the 40th most commonly observed IPS, occurring on 5 of 13,659 plots (<0.1 percent; Table 2). Asiatic tearthumb was observed in the states of Maryland, Pennsylvania, and West Virginia (Fig. 7).

Figure 6.— Asiatic tearthumb. Photo by Bruce Ackley, The Ohio State University, Bugwood.org.

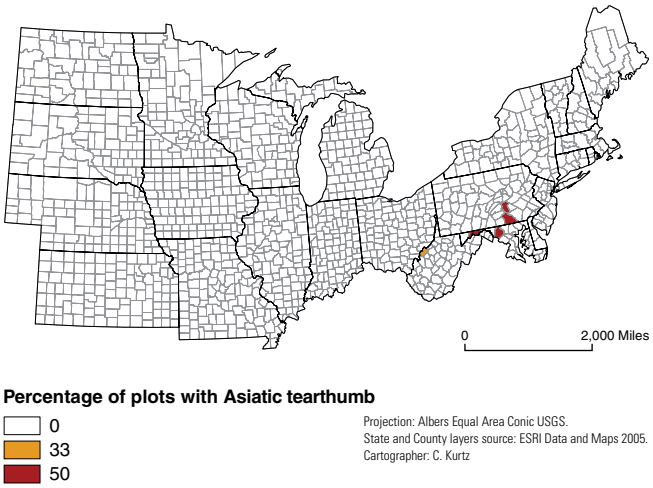

Figure 7.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2005-2006) and P3 plots (2005-2010) where Asiatic tearthumb was observed, by county.

Autumn olive

(Elaeagnus umbellata)
ELUM

Background and characteristics: Autumn olive, a shrub of the oleaster family (Elaeagnaceae), is native to China, Japan, and Korea and was introduced to the United States in 1830 (Czarapata 2005, Kaufman and Kaufman 2007, Smith 1997). It has many characteristics of a successful invader. Autumn olive tolerates poor quality sites, is valuable as a visual screen for hedging and windrows, produces an abundance of fruit (Fig. 8), and has desirable wildlife characteristics, traits that encourage the planting of this species. Federal agencies also helped to further spread this species by promoting the planting of autumn olive (Zouhar et al. 2008). In areas where it is planted, birds and animals contribute to its spread by readily dispersing the fruit.

Autumn olive is somewhat shade tolerant but is very rarely found in the deep shade of dense forests or on wet sites (Czarapata 2005, Smith 1997). Since this invader is tolerant of poor quality sites and full sun, it has been used for mine reclamation (Czarapata 2005). Where it does establish, the dense shrub hinders the growth of understory plants and can alter the forest community. Autumn olive can also impact the plant community by adding nitrogen to the soil, altering the nutrient cycle (Czarapata 2005, Kaufman and Kaufman 2007). These characteristics are a concern to land managers and can be problematic for restoration.

According to the Plants Database (USDA, NRCS 2012), several site characteristics restrict the presence of autumn olive. This noxious shrub can survive to -23.0 °F and requires 28.0 to 45.0 inches of precipitation annually, 150 or more frost free days, pH levels between 5.0 and 7.5, and a minimum rooting depth of 18.0 inches. Additional limits to its presence are its intolerance of anaerobic soils and cold stratification requirement.

Current distribution: Autumn olive is now found in 36 states with Connecticut listing it as invasive and banned, Massachusetts and New Hampshire as prohibited, and West Virginia as noxious; it is also found in Ontario, Canada (USDA, NRCS 2012).

P2 and P3 monitoring: Autumn olive was monitored on NRS FIA P2 invasive plots from 2005 through 2010 and on P3 plots from 2005 through 2006. It was the ninth most commonly observed IPS, occurring on 553 of the 18,929 plots (3.0 percent; Table 2). It ranked among the five most commonly observed IPS monitored on FIA plots (Table 3) in Delaware, Illinois, Indiana, Michigan, Rhode Island, and West Virginia. West Virginia and Ohio had the highest proportion of plots with this species at 20.2 and 12.3 percent, respectively. Even though Michigan had the largest number of plots with autumn olive (158 plots; Fig. 9), it was only present on 3.2 percent of monitored plots. The large number of occurrences reflects the survey intensification in Michigan, where 4,984 plots were monitored from 2005 through 2010, representing 26.3 percent of the total number of plots in the NRS FIA region for this timeframe. Autumn olive was not recorded in five states: Maine, Nebraska, North Dakota, South Dakota, and Vermont.

Figure 8.— Autumn olive with fruit. Photo by Pennsylvania Department of Conservation and Natural Resources-Forestry Archive, Bugwood.org.

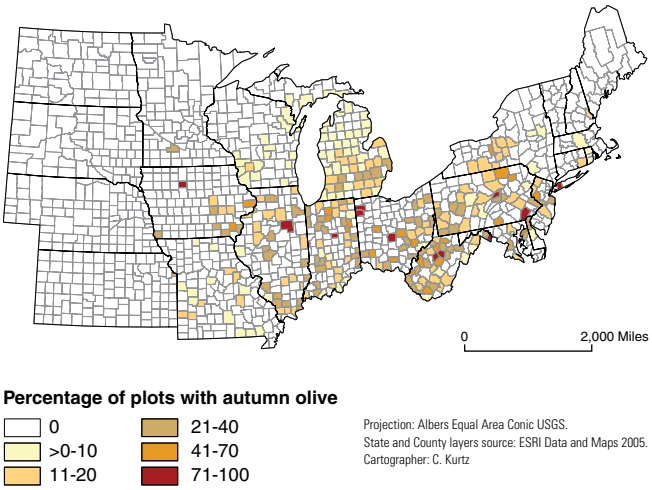

Figure 9.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2005-2010) and P3 plots (2005-2006) where autumn olive was observed, by county.

Black locust

(Robinia pseudoacacia)

ROPS

Background and characteristics: Black locust, a fast-growing invasive tree of the legume family (Fabaceae), is native to the Appalachian Mountains and Ozark Plateau but has spread out of its native range (Czarapata 2005, Kaufman and Kaufman 2007). A leguminous species, black locust can change the soil nitrogen level and species composition. It can tolerate dry, nutrient poor soils and is shade intolerant, characteristics that have contributed to its use in mine reclamation (Kaufman and Kaufman 2007). The spread of this species is also facilitated by people planting this tree for its proliferation of beautiful white flowers (Fig. 10). Its rapid growth coupled with aggressive suckering, sprouting, and seed production have helped this IPS succeed in the forest community where it shades competing vegetation. This short-lived invader is considered to have the most durable wood of any species in North America (Smith 1997).

Aside from the invasive tendencies of this species, black locust is medicinally important. American Indians chewed the root bark to induce vomiting and held the bark in the mouth to relieve toothaches (Foster and Duke 2000). It is also reported the flowers are used for fritters (Peterson 1977), and the species is used as a diuretic and for rheumatism, however all parts are potentially toxic and the flower odor can cause nausea and headaches (Foster and Duke 2000).

According to the Plants Database (USDA, NRCS 2012), it is suggested -37.0 °F is the northern limit of cold tolerance for black locust and it requires 16.0 to 65.0 inches of precipitation annually, a minimum of 140 days frost free, pH of 4.6 to 8.2, and rooting depth of at least 36.0 inches.

Current distribution: This IPS is now found in six Canadian provinces (British Columbia, New Brunswick, Nova Scotia, Ontario, Prince Edward Island, and Quebec) and the entire conterminous United States, with Connecticut classifying it as an invasive and Massachusetts as a prohibited species (USDA, NRCS 2012).

P2 and P3 monitoring: Black locust was monitored on NRS FIA P2 invasive plots from 2007 through 2010 and on P3 plots from 2005 through 2006. It was the second most commonly observed IPS, occurring on 382 of 7,107 plots (5.4 percent; Table 2). Black locust primarily occurs in the southern two-thirds of the NRS region with a few scattered observances in the northern third (Fig. 11). West Virginia had more than a quarter of the plots with this species present (39.3 percent), with Ohio and Maryland closely following (23.3 and 16.9 percent, respectively). It was also ranked among the five most commonly observed IPS monitored on FIA plots in Missouri, Ohio, Pennsylvania, and West Virginia (Table 3). However, black locust was not recorded in six states of the NRS FIA region: Maine, Minnesota, Nebraska, New Hampshire, North Dakota, and South Dakota.

Figure 10.— Black locust in flower. Photo by Jan Samanek, State Phytosanitary Administration, Bugwood.org.

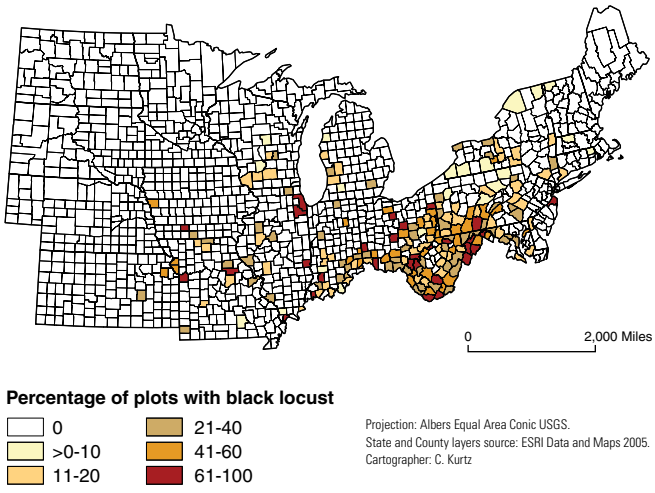

Figure 11.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2007-2010) and P3 plots (2005-2006) where black locust was observed, by county.

Bohemian knotweed

(Polygonum* x *bohemica* syn. *P.* x *bohemicum; Fallopia* x *bohemica; F.* x *bohemicum; Reynoutria* x *bohemica; R.* x *bohemicum)
POBO10

Background and characteristics: Bohemian knotweed is an herbaceous perennial of the buckwheat family (Polygonaceae). It is a hybrid between Japanese knotweed and giant knotweed which are native to northeastern Asia and were introduced as ornamentals to Europe in the second half of the 19th century and to North America as ornamentals and fodder in the late 19th century (Murrell et al. 2011, Urgenson et al. 2009). Bohemian knotweed grows best in full sun (Fig. 12) but can tolerate some shade.

Bohemian knotweed is considered to be one of the world's worst invasive species due to its aggressive nature, enabling it to destabilize banks along waterways and inflict structural damage to pavement and buildings (Murrell et al. 2011). Murrell et al. (2011) suggest the success of this species is not only from its ability to outcompete surrounding vegetation but may also be from allelopathic effects.

Current distribution: The extent of Bohemian knotweed presence is controversial. Urgenson (2006) suggests it is the most successful (and difficult to control) species of the *Polygonum* congeners in terms of regeneration and new shoot establishment and is thought to be more common in the United States than either of the parent species, whereas the PLANTS Database (USDA, NRCS 2012) does not show any occurrences of this species in the United States. Nevertheless, it does indicate Bohemian knotweed is present in three Canadian provinces (British Columbia, Ontario, and Quebec) and is considered a noxious weed in Washington.

P2 and P3 monitoring: Bohemian knotweed was monitored on NRS FIA P2 invasive plots from 2007 through 2010 and on P3 plots from 2005 through 2006. It was tied with saltcedar (*Tamarix ramosissima*) and silktree (*Albizia julibrissin*) as the 41st most commonly observed IPS. These three IPS were each found on 2 of 7,107 plots (<0.1 percent; Table 2). Bohemian knotweed was observed in two states of the NRS FIA region, Maryland and Pennsylvania (Fig. 13).

Figure 12.— Bohemian knotweed, in flower, growing along a stream. Photo by Barbara Tokarska-Guzik, University of Silesia, Bugwood.org.

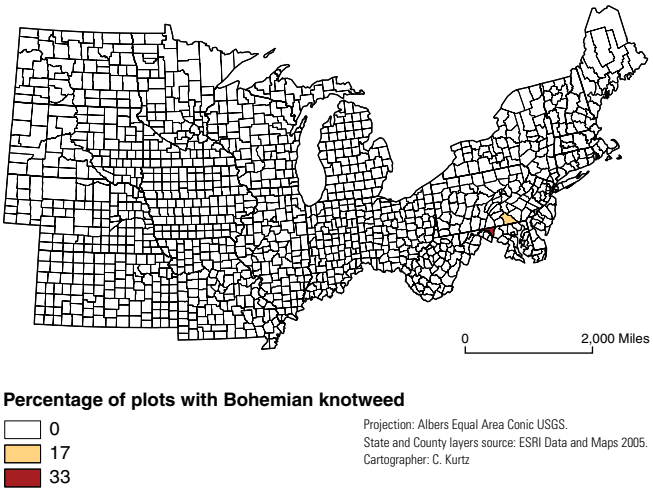

Figure 13.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2007-2010) and P3 plots (2005-2006) where Bohemian knotweed was observed, by county.

Bull thistle

(Cirsium vulgare)
CIVU

Background and characteristics: Bull thistle, also known as spear thistle, is a biennial of the aster family (Asteraceae) that is native to Europe and Asia and was likely introduced during colonial times (Randall and Rejmánek 1993). It is most commonly observed on mesic soils but can be found on xeric and hydric soils. Germination ranges between 60.0 and 90.0 percent and is reduced when the temperature is less than 50.0 °F and greater than 86.0 °F. In the shade, growth is restricted to south facing slopes, and it was found 55.0 percent of full daylight caused rosette growth, the number of seeds per plant, and the percent viable seeds to be greatest (Klinkhamer and De Jong 1993). Where bull thistle establishes, it can form dense vegetation masses. A study by Randall and Rejmánek (1993) showed high densities of bull thistle reduced the growth rate of pines 25.0 to 33.0 percent and suggested this plant may have allelopathic effects that interfere with seedling growth.

This species is a concern in agricultural and forested regions as well as along roadways and in disturbed areas. Sharp spines on the stems and leaves make working conditions undesirable (Fig. 14), and the effects of infestations from this noxious weed are substantial. In agricultural areas it is unpalatable to most livestock. In addition, sheep grazing contributes to the spread of this IPS by reducing competition from other plants and increasing the growth, flowering, and seed production of the thistle plants (Klinkhamer and De Jong 1993). Despite its negative impacts, some individuals eat the young leaves, stems, and roots (Peterson 1977).

Current distribution: Bull thistle is now found in all 50 states with 9 states listing it as a noxious weed; it is also found in all 10 Canadian provinces (not present in Labrador), the Northwest Territory, Greenland, Saint Pierre, and Miquelon (USDA, NRCS 2012). Its distribution in Europe closely follows that of cultivated land, and in Canada bull thistle is found in agricultural areas but is absent from the prairie region (Klinkhamer and De Jong 1993).

Figure 14.—Bull thistle in flower. Photo by Britt Slattery, U.S. Fish and Wildlife Service, Bugwood.org.

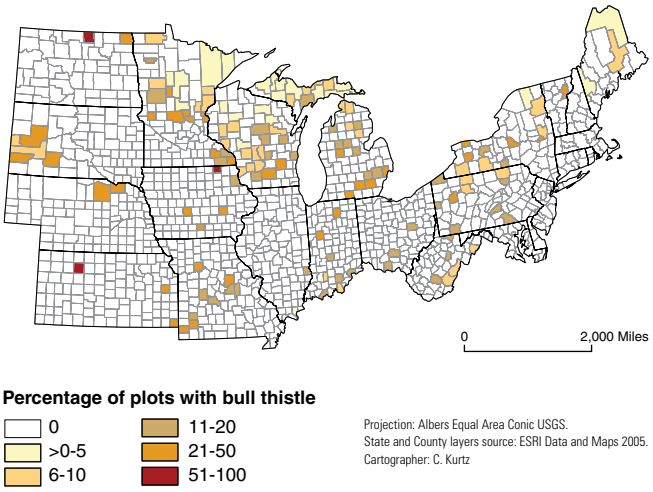

Figure 15.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2007-2010) and P3 plots (2005-2006) where bull thistle was observed, by county.

P2 and P3 monitoring: Bull thistle was monitored on NRS FIA P2 invasive plots from 2007 through 2010 and on P3 plots from 2005 through 2006. It was the 11th most commonly observed IPS, occurring on 184 of 7,107 plots (2.6 percent, Table 2). This herbaceous weed ranked among the five most commonly observed IPS monitored on FIA plots in eight states of the NRS region and was the most commonly observed IPS in South Dakota (Table 3). In the region, South Dakota had the highest proportion (11.5 percent) of forested plots with bull thistle. Bull thistle was not recorded in 7 of the 24 states, all of which were along the Atlantic coast (Delaware, Connecticut, Massachusetts, Maryland, New Jersey, New Hampshire, and Rhode Island; Fig. 15).

Canada thistle

(Cirsium arvense)
CIAR4

Background and characteristics: Canada thistle, an aggressive herbaceous perennial of the aster family (Asteraceae), arrived to North America in the early 1600s in contaminated crop seed from Europe and has displaced native flora and fauna as well as reduced crop and pasture productivity (Czarapata 2005, Kaufman and Kaufman 2007). It is able to reduce crop yields 100 percent (Royer and Dickinson 1999), costing tens of millions of dollars in annual crop loss (Fig. 16) and millions more for its control (Czarapata 2005). A single Canada thistle plant produces from 1,500 to 5,000 seeds that remain viable up to 20 years (Czarapata 2005, Smith 1997). Due to the large number of seeds produced and the length of time the seeds remain viable, there are substantial restoration costs because of the need for continual removal over a long period of time.

Optimal growth of Canada thistle occurs in full sun. Where it does establish, this IPS sends out extensive running roots (Kaufman and Kaufman 2007). Along the stem of the plant are sharp spines that protect the plant from cattle browse. The disturbance caused by animals helps to facilitate the growth of this species since it is most successful in disturbed areas.

Aside from the negative impacts, this plant has medicinal qualities. It is reported to have value for skin eruptions and ulcers, poison ivy rash, and tuberculosis treatment (Foster and Duke 2000). The leaves have traditionally been used as a diuretic while the roots were used for dysentery, diarrhea, bowel tonic, and dewormer (Foster and Duke 2000). Despite being a plant of substantial medicinal value, this IPS is a problematic landscape weed and is considered noxious in much of the United States. Its hardiness allows it to survive throughout North America with its northern limit corresponding to an average January temperature of -40.0 °F (Royer and Dickinson 1999).

Current distribution: Currently it is found in 42 states (not recorded in Hawaii and seven Southern/Southeastern states), listed as a noxious weed in 31 states, potentially invasive/banned in Connecticut, and a Class B weed/quarantine in Oregon. This herbaceous perennial is also found in all 10 Canadian provinces (not present in Labrador), two Canadian territories (Northwest and Yukon Territory), Greenland, Saint Pierre, and Miquelon (USDA, NRCS 2012).

Figure16.—Canada thistle infestation in a canola field. Photo by Alec McClay, McClay Ecoscience, Bugwood.org.

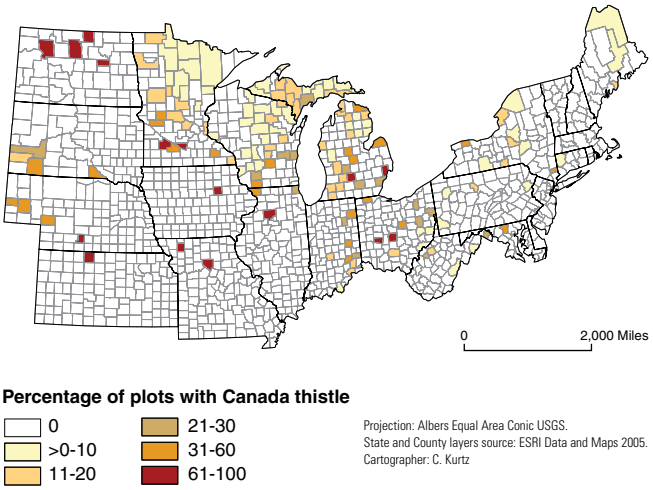

Figure 17.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2007-2010) and P3 plots (2005-2006) where Canada thistle was observed, by county.

P2 and P3 monitoring: Canada thistle was monitored on NRS FIA P2 invasive plots from 2007 through 2010 and on P3 plots from 2005 through 2006. It was the eighth most commonly observed IPS, occurring on 231 of 7,107 plots (3.3 percent; Table 2). This herbaceous weed ranked among the five most commonly observed IPS monitored in five states of the NRS FIA region (Michigan, Minnesota, Nebraska, North Dakota, and South Dakota) and was the most commonly observed IPS in Michigan and North Dakota (Table 3). In this region, the highest percentage of plots with Canada thistle was in North Dakota (20.0 percent), with the second highest percentage in South Dakota (11.5 percent). Canada thistle was not detected in six states: Delaware, Massachusetts, New Hampshire, New Jersey, Rhode Island, and Vermont (Fig. 17).

Chinaberry

(Melia azedarach)
MEAZ

Background and characteristics: Chinaberry, also known as umbrella tree, Persian lilac, and bead tree, is a member of the mahogany (Meliaceae) family and can grow to 50.0 feet. It is native to Asia and northern Australia and was introduced as a shade tree in the southeast during the 1830s (Kaufman and Kaufman 2007). Grown for its ornamental value, this tree is aesthetically pleasing with stunning, fragrant flowers (Fig. 18), attractive berries, and majestic compound leaves.

Chinaberry is able to grow in relatively undisturbed areas and can tolerate high temperatures, poor soils, and periods of drought (Kaufman and Kaufman 2007). Its leaves are capable of changing soil properties. When the leaves decay, they increase the soil nitrogen and decrease the pH (Kaufman and Kaufman 2007). These ecosystem modifications can impact the vegetation and change the plant community.

Aside from the ecosystem impacts caused by this species, Chinaberry has several notable characteristics. Its leaves are used in some countries for insecticides, and the seeds are used to stun freshwater fish (Kaufman and Kaufman 2007). Medicinal uses have also been reported, including the treatment of leprosy and eczema, relief from asthma attacks, and as an antiparasitic and antifungal agent (Ferreiro et al. 2010). Despite the beneficial properties of this tree, it can also be deadly. The most toxic part of the tree is the fruits, and poisoning has been reported in children, horses, cattle, sheep, goats, pigs, dogs, rabbits, rats, guinea pigs, and poultry (Ferreiro et al. 2010).

Current distribution: Chinaberry is found in 18 continental states, along with Hawaii, Puerto Rico, and the Virgin Islands (USDA, NRCS 2012).

P2 and P3 monitoring: Chinaberry was monitored on NRS FIA P2 invasive plots from 2007 through 2010 and on P3 plots from 2005 through 2006. It tied with European swallow-wort as the 45th most commonly observed IPS and was observed on 1 of the 7,107 plots (<0.1 percent; Table 2), in New York (Fig. 19).

Figure 18.—Chinaberry in flower. Photo by Chuck Bargeron, University of Georgia, Bugwood.org.

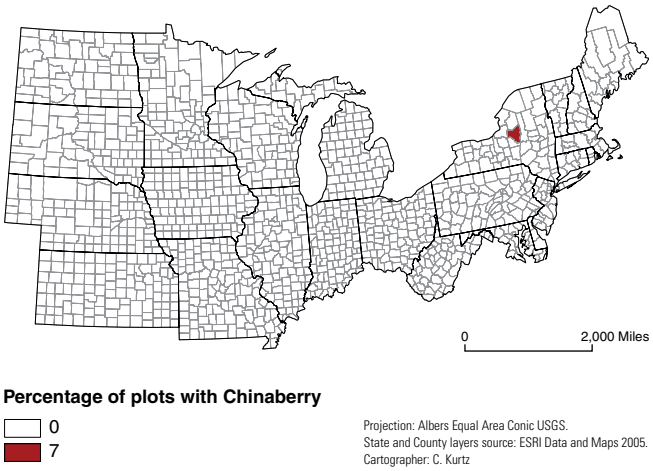

Figure 19.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2007-2010) and P3 plots (2005-2006) where Chinaberry was observed, by county.

Chinese yam

(Dioscorea oppositifolia* syn. *D. polystachya)
DIOP

Background and characteristics: Chinese yam, also known as cinnamon vine, is an herbaceous vine of the yam family (Dioscoreaceae) that is native to China and India and was introduced to North America in the 1800s as a food plant or ornamental, but it was not until the 1980s when it was noticed in the wild. This herbaceous invader (Fig. 20) is most common in rich soil along streams or in floodplains and tolerates a wide range of light availability from full sun to shade (Kaufman and Kaufman 2007). Chinese yam can reach up to 15.0 feet long (Czarapata 2005).

A variety of uses have been discovered for Chinese yam (Kaufman and Kaufman 2007). The tuberous roots and above-ground 'tubers' are eaten and taste similar to a sweet potato. Medicinally, Chinese yam is reported to be valuable for snakebites and scorpion stings, as a contraceptive, and an herbal tonic.

Current distribution: Chinese yam is found in 26 states (USDA, NRCS 2012).

P2 and P3 monitoring: Chinese yam was monitored on NRS FIA P2 invasive plots from 2005 through 2006 and on P3 plots from 2005 through 2010. It was the 37th most commonly observed IPS, occurring on 9 of 13,659 plots (0.1 percent; Table 2), and was observed in three states: Illinois, Indiana, and Missouri (Fig. 21). The highest percentage of plots with Chinese yam present occurred in Indiana (6 plots; 1.3 percent).

Figure 20.—Chinese yam infestation. Photo by Chris Evans, River to River CWMA, Bugwood.org.

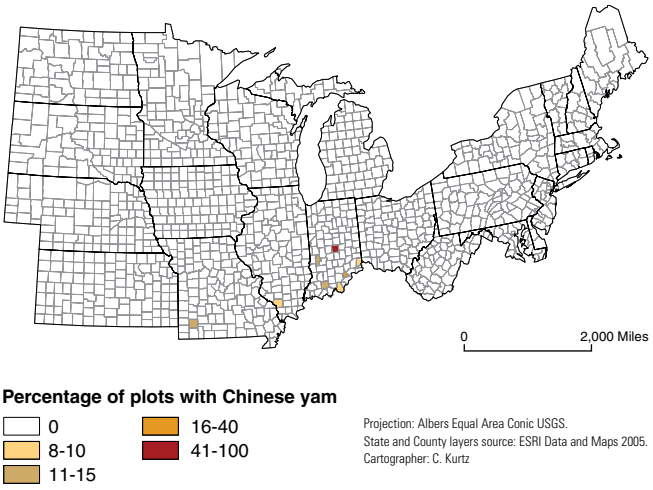

Figure 21.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2005-2006) and P3 plots (2005-2010) where Chinese yam was observed, by county.

Common barberry

(Berberis vulgaris)

BEVU

Background and characteristics: Common barberry is a shrub of the barberry family (Berberidaceae) and was likely introduced in the 1600s for use in sauces and as a medicinal plant (Mack 2003, Royer and Dickinson 1999). Common barberry develops clusters of yellow flowers (Fig. 22) and produces seeds that are vectored by birds, increasing the likelihood of long-distance dispersal. The plants can bear fruit in as few as 4 years and the seeds remain viable for at least 7 years (Peterson et al. 2005).

Common barberry is an alternate host for wheat stem rust (*Puccinia graminis*) which reduces the crop yield of wheat, oats, barley, and other grasses (Royer and Dickinson 1999). Early descriptions of its infection on wheat are described in New England in the 1660s (Mack 2003). In the early 1700s, legislation began to pass to control barberry beginning with Connecticut in 1726 and followed by Massachusetts (1755) and Rhode Island (1772). By the time control efforts were implemented, common barberry was widespread in 13 states (Mack 2003). The early 1900s commonly had severe stem rust epidemics which reduced yields 50.0 to 70.0 percent with some fields completely lost (Peterson et al. 2005). From 1918 until the 1980s, state eradication campaigns ran which destroyed over 500 million bushes (Peterson et al. 2005). The senescence of this program may have been premature since there are still inoculums, as shown in Figure 23.

Aside from its invasive characteristics, common barberry has been used for several important medicinal purposes (Foster and Duke 2000). The berberine from this IPS is reported to be valuable for promoting appetite and sweating, as a diuretic, expectorant, laxative, astringent, antiseptic, blood purifier, and antibacterial. It has traditionally been used for itch relief and to treat jaundice, hepatitis, fevers, hemorrhage, diarrhea, coughs, arthritis, rheumatism, sciatica, and to increase white blood cell and platelet counts (from berbamine). Other uses for this plant include: jellies, cold drinks, and cooked fruit (Peterson 1977).

Current distribution: Common barberry is found in eight Canadian provinces and 31 states, with Connecticut listing it as invasive and banned and Massachusetts and New Hampshire listing it as prohibited (USDA, NRCS 2012).

Figure 22.—Common barberry in flower. Photo by Leslie J. Mehrhoff, University of Connecticut, Bugwood.org.

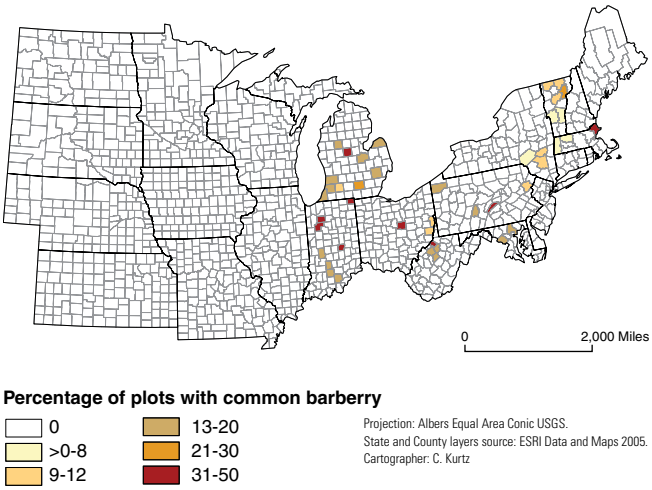

Figure 23.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2007-2010) and P3 plots (2005-2006) where common barberry was observed, by county.

P2 and P3 monitoring: Common barberry was monitored on NRS FIA P2 invasive plots from 2007 through 2010 and on P3 plots from 2005 through 2006. It was the 24th most commonly observed IPS, occurring on 43 of 7,107 plots (0.6 percent; Table 2). This invasive shrub was observed in nine states in the eastern part of this region with the highest percentage of plots with common barberry occurring in Vermont (4.3 percent).

Common buckthorn

(Rhamnus cathartica)
RHCA3

Background and characteristics: Common buckthorn, also known as European buckthorn, is a woody shrub of the buckthorn family (Rhamnaceae) that is native to Eurasia and was brought to North America from Europe by the 1800s as an ornamental (Knight et al. 2007). In North America, the introduced buckthorns can easily be confused with native look-alikes such as Carolina buckthorn (*Rhamnus caroliniana*) and alder buckthorn (*Rhamnus alnifolia*). As with all species, accurate identification is important.

Common buckthorn produces an abundance of fruit (Fig. 24). Its seeds are dispersed by birds and mammals, and it creates dense thickets that hinder the growth of other species due to leafing out early and shading the forest floor. In Wisconsin this aggressive invader gains as much as 35.0 percent of its annual carbon before leaf emergence of native species, and its leaves are retained an average of 58 days longer than comparable native shrubs (Delanoy and Archibold 2007). These traits give buckthorn a competitive advantage.

Common buckthorn's ability to survive in the understory is also important to its success. Though shade tolerant, optimal growth occurs in areas with more light, and vigor is reduced in deep shade (Knight et al. 2007). Where common buckthorn establishes, its success may be facilitated by its high foliar nitrogen concentration which stimulates earthworm invasion and litter decomposition (Kaufman and Kaufman 2007, Knight et al. 2007).

The spread of common buckthorn occurs from a few sources. From a horticultural standpoint, people have interest in this species as a hedge. When left naturally, nonnative buckthorns can reach up to 25.0 feet tall (Czarapata 2005, Kaufman and Kaufman 2007). The planting of common buckthorn was also promoted by federal agencies (Zouhar et al. 2008), and its aggressive nature has enabled it to become naturalized throughout the United States.

Figure 24.—Common buckthorn with fruit. Photo by Cassandra Kurtz, U.S. Forest Service.

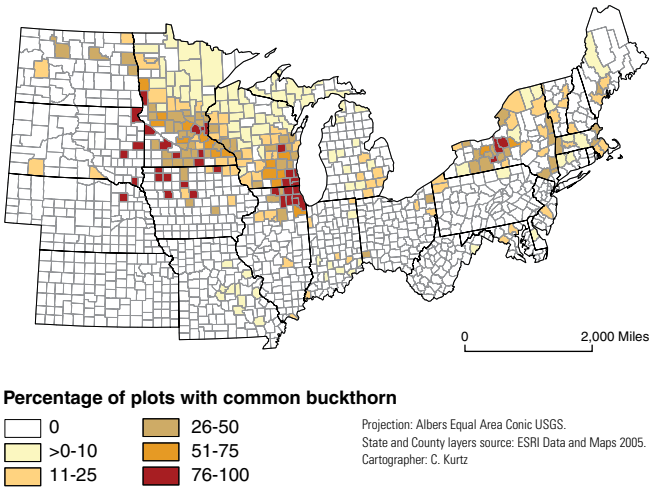

Figure 25.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2005-2010) and P3 plots (2005-2006) where common buckthorn was observed, by county.

The presence of common buckthorn is a concern. Common buckthorn may be allelopathic (Delanoy and Archibold 2007, Knight et al. 2007) and affect the survival of other species. Agriculturally, common buckthorn is troublesome as it is an alternate host of oat crown rust (*Puccinia coronata*) and the primary overwintering host of the Asian soybean aphid (*Aphis glycines*). Aside from the negative impacts caused by this species, some have found this invader useful for making dyes and as a medicinal plant (Gould and Stuckey 1992).

In North America, the range of common buckthorn is climatically restricted. To germinate, a chilling period is required and seedling survival is reduced by hot summers, cold winters, thick litter layers, and acidic/dry/water-logged soils (Knight et al. 2007, Kurtz 2010, Kurylo et al. 2007). Spring and fall frost damage further restricts its distribution with establishment occurring where it utilizes the entire growing season by maximizing carbon fixation and proper hardening/dehardening (Knight et al. 2007, Kurylo et al. 2007). Moser et al. (2009) note a reduction in the presence of this IPS south of 42.0° N latitude which can also be seen in Figure 25. It is thought this species may be restricted from northward establishment due to global warming because of the substrate (Kurylo et al. 2007).

Current distribution: Common buckthorn is found in 34 states with 6 (Connecticut, Iowa, Massachusetts, Minnesota, New Hampshire, and Vermont) classifying it as banned, prohibited, restricted, or noxious. It is also found in eight Canadian provinces but is not recorded in British Columbia, Labrador, and Newfoundland (USDA, NRCS 2012).

P2 and P3 monitoring: Common buckthorn was monitored on NRS FIA P2 invasive plots from 2005 through 2010 and on P3 plots from 2005 through 2006. It was the fourth most commonly observed IPS, occurring on 836 of the 18,929 plots (4.4 percent; Table 2). In New York, Massachusetts, and Wisconsin, common buckthorn was present on 10.0 percent or more of the field plots (16.8, 12.3, and 10.0 percent, respectively). It also ranked among the five most frequently recorded IPS in eight states of the NRS FIA region and was the most common invasive observed in Minnesota and Vermont (Table 3). The data from 2005 through 2010 reflect a trend found with the 2005 and 2006 FIA data (Kurtz 2010, Moser et al. 2009) where presence was highest along the prairie tension zone which extends from northwest Minnesota to southeast Wisconsin. This zone represents an area heavily fragmented by agriculture, cities, and roadways. Only two states in the NRS FIA region, Kansas and Rhode Island, did not have common buckthorn present on the field plots.

Common reed

(Phragmites australis)
PHAU7

Background and characteristics: Common reed, also known as phragmites, is a member of the grass family (Poaceae). It has over 20 genetic strains or lineages with 11 considered native, rare, and worth special efforts to preserve by some researchers (Kaufman and Kaufman 2007). A 10.0 foot tall species has taken over thousands of acres of marshes in New England, where it displaces rare native species like the lady's slipper (*Cypripedium* species) and spotted turtles (*Clemmys guttata*) (Westbrooks 1998).

Common reed is shade intolerant and generally found in wet areas. It is tolerant of brackish waters and spreads mainly through root fragments carried by water (Kaufman and Kaufman 2007). This aggressive invader can take over an area in just a few years. The dense colonies formed by common reed can be used to remove pollutants from the ground, the rhizomes are roasted, seeds are used for porridge, and blades are used for thatching roofs (Kaufman and Kaufman 2007). It also is used to stabilize shorelines, provide cover for wildlife, and for fishing rods (Czarapata 2005). Even though useful benefits have been derived from this IPS, the costs to ecosystems far outweigh the benefits. In an ecosystem, this graminoid can form dense colonies (Fig. 26) which supplant native species and alter water flow.

The USDA PLANTS Database (USDA, NRCS 2012) suggests this noxious weed can survive to -38.0 °F and requires 12.0 to 60.0 inches of precipitation annually, 110 or more frost free days, pH levels between 4.5 and 8.7, and a minimum rooting depth of 20.0 inches. Additional qualities that enable common reed to invade a wide variety of locations are its adaptability to fine, medium, and coarse textured soils and its high anaerobic tolerance, though it does have low drought tolerance.

Current distribution: Common reed is found in all 10 Canadian provinces (not present in Labrador), one territory (Northwest Territory), Saint Pierre and Miquelon, and 49 states (not in Alaska), with six states listing it as noxious, prohibited, or invasive (USDA, NRCS 2012).

Figure 26.—Common reed infestation. Photo by John M. Randall, The Nature Conservancy, Bugwood.org.

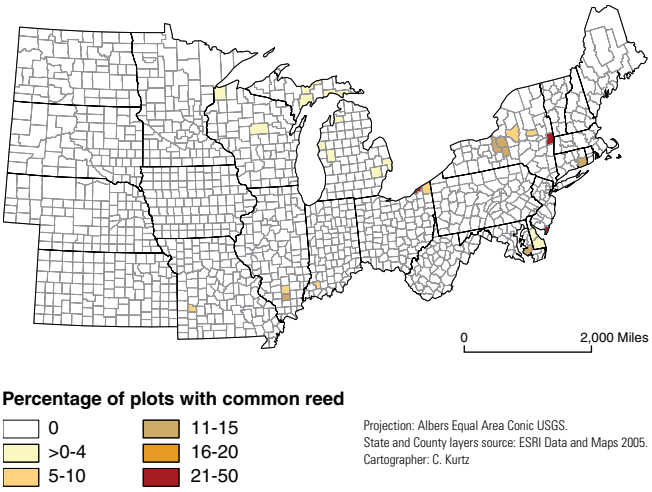

Figure 27.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2005-2010) and P3 plots (2005-2006) where common reed was observed, by county.

P2 and P3 monitoring: Common reed was monitored on NRS FIA P2 invasive plots from 2005 through 2010 and on P3 plots from 2005 through 2006. It was the 34th most commonly observed IPS, occurring on 28 of 18,929 plots (0.1 percent; Table 2). This invasive graminoid was recorded in 11 states of the NRS FIA region (Fig. 27).

Creeping jenny

(Lysimachia nummularia)
LYNU

Background and characteristics: Creeping jenny, also known as moneywort and wandering sailor, is an herbaceous plant of the primrose family (Primulaceae) that was introduced from Europe and southwest Asia as an ornamental groundcover (USFS, FHS 2005). It is a popular groundcover since it spreads very rapidly and has shiny rounded leaves and yellow flowers (Fig. 28). Cultivars of this species have been bred and are widely available as landscape plants.

Creeping jenny grows in sun to part shade and rapidly spreads to smother neighboring vegetation. Optimal growth occurs in moist areas such as along waterways where it can form dense mats and displace native vegetation. Spread is by both vegetative propagules and seed.

Current distribution: Creeping jenny is now found in 37 states with Connecticut listing it as potentially invasive and Massachusetts as prohibited. It is also found in seven Canadian provinces: British Columbia, New Brunswick, Newfoundland, Nova Scotia, Ontario, Prince Edward Island, and Quebec (USDA, NRCS 2012).

P2 and P3 monitoring: Creeping jenny was monitored on NRS FIA P2 invasive plots from 2007 through 2010 and on P3 plots from 2005 through 2006. It was the 17th most commonly observed IPS, occurring on 94 of 7,107 plots (1.3 percent; Table 2). Creeping jenny was observed in 12 states of the NRS FIA region (Fig. 29) with Ohio and New York having the highest percentage of plots with this species (7.9 and 5.5 percent, respectively).

Figure 28.—Creeping jenny in flower. Photo by Richard Old, XID Services, Inc., Bugwood.org.

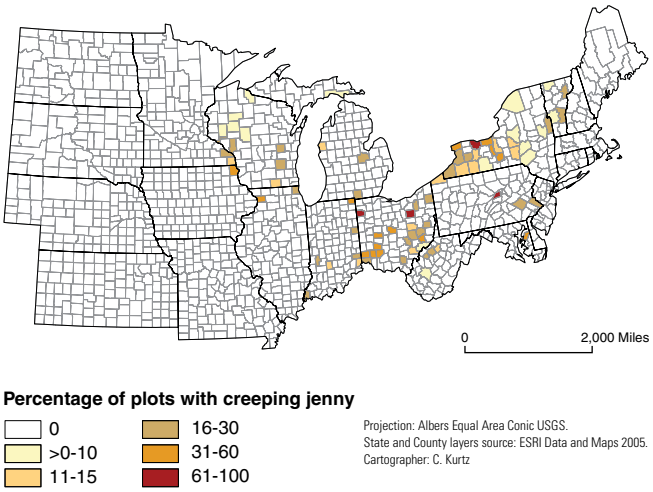

Figure 29.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2007-2010) and P3 plots (2005-2006) where creeping jenny was observed, by county.

Dames rocket

(Hesperis matronalis)
HEMA3

Background and characteristics: Dames rocket, an herbaceous perennial of the mustard family (Brassicaceae), was introduced from Europe in the 1600s (Kaufman and Kaufman 2007, Susko and Hussein 2008). It is often found in disturbed areas such as along roadsides. The spread of this species is facilitated by humans since they frequently plant this flower because it is colorful, easy to grow, and relatively carefree. Dames rocket seeds are a common component of wildflower mixes. The fragrant flowers are predominantly purple though some are pink or white (Fig. 30). Dames rocket plants are distinguishable from phlox (*Phlox* spp.) as the flowers have four petals versus phlox which has five. Each plant produces an abundance of flowers which mature into wiry seed pods filled with seeds. A plant is capable of producing up to 20,000 seeds (Royer and Dickinson 1999) that can remain viable for several years. The seeds are often transported in storms and via humans by sticking to their shoes and vehicle tires, and by attaching to the feet and fur of animals.

Animals also spread dames rocket by creating disturbances. The disturbance exposes mineral soil and increases light availability. Deer may contribute to germination by browsing other plant species instead of dames rocket and creating soil disturbances that facilitate growth (Rawinski 2008). This noxious weed can grow in full sun or shade but does best in sun conditions (Kamm 2004). Recently there has been some interest in this plant as a potential biofuel energy crop. Kamm (2004) found this plant, as a crop plant, offers an impressive yield and may be an economical biomass alternative.

According to the USDA PLANTS Database (USDA, NRCS 2012), it is suggested dames rocket does not require cold stratification, and its growth is restricted by fertility (medium tolerance, not adapted to fine or coarse soils), precipitation (requires 32.0 to 60.0 inches annually), temperature (-23.0 °F minimum), frost free days (120 minimum), pH (tolerates a range from 5.0 to 7.0), rooting depth (12.0 inch minimum), $CaCO_3$ (low tolerance), fire (low tolerance), and salinity (no tolerance).

Current distribution: Dames rocket occurs in 10 Canadian provinces (not present in Labrador), the Northwest Territories, and 41 states (absent from eight Southern states and Hawaii). It is classified as a noxious weed in Colorado and New Mexico and potentially invasive and banned in Connecticut (USDA, NRCS 2012). The distribution of this IPS has important agricultural implications as it is an alternate host of several crop mosaic viruses including ribgrass (RMV), cucumber (CMV), beet (BtMV), cauliflower (CaMV), radish (RaMV), squash (SqMV), and turnip (TuMV) mosaic viruses (Kaufman and Kaufman 2007, Royer and Dickinson 1999, Susko and Hussein 2008).

Figure 30.—The early stage of infestation by dames rocket, shown in flower (purple and white). Photo by Cassandra Kurtz, U.S. Forest Service.

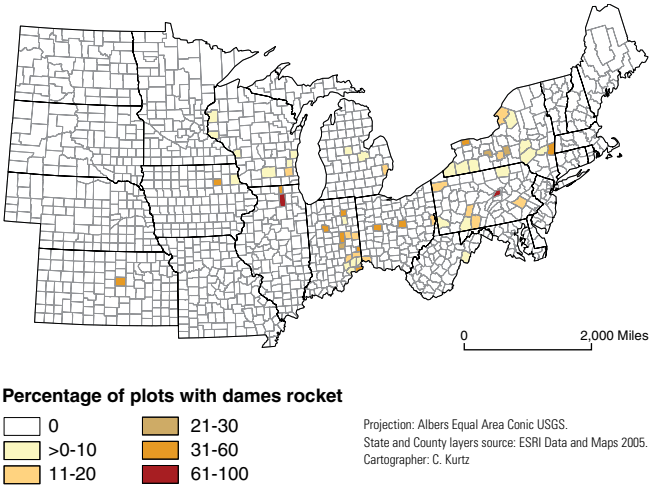

Figure 31.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2005-2010) and P3 plots (2005-2006) where dames rocket was observed, by county.

P2 and P3 monitoring: Dames rocket was monitored on NRS FIA P2 invasive plots from 2005 through 2010 and on P3 plots from 2005 through 2006. It was the 28th most commonly observed IPS, occurring on 64 of 18,929 plots (0.3 percent; Table 2). Dames rocket was observed in 10 states of the NRS FIA region (Fig. 31), each with less than 3.0 percent of the plots containing this aggressive invader.

English ivy

(Hedera helix)

Background and characteristics: English ivy is a woody vine of the ginseng family (Araliaceae). It is native to Europe, western Asia, and northern Africa and was brought to North America (first recorded in 1727) by European colonists as a decorative plant (Kaufman and Kaufman 2007). Due to the ease of growing this plant, English ivy is common both indoors and outdoors. The popularity of this vine has resulted in several variegated cultivars being bred for ornamental use.

English ivy is most abundant in the Pacific Northwest and on the East Coast of the United States where it is generally found on moist sites in shade to part shade, though it can tolerate drought. This invasive vine produces berries that are mildly toxic so few bird species eat them (Kaufman and Kaufman 2007). It thrives in disturbed areas and can reach up to 90.0 feet long (Czarapata 2005, Kaufman and Kaufman 2007). The rapid growing vines climb up vegetation (Fig. 32) and can increase the surface area and windthrow potential, impede photosynthesis, and girdle vegetation. English ivy has important fire implications as it can potentially increase the fuel load and chance of a crown fire by creating fuel continuity (Zouhar et al. 2008).

Based on the literature and field observations (USDA, NRCS 2012), it is suggested English ivy can survive to -23.0 °F and requires 28.0 to 65.0 inches of precipitation annually, 160 or more frost free days, pH levels between 5.2 and 7.8, a minimum rooting depth of 12.0 inches, and aerobic conditions.

Current distribution: Since its introduction in 1727, it has spread to one Canadian province (British Columbia) and 31 states, with two states (Oregon and Washington) classifying this aggressive invader as noxious (USDA NRCS 2011).

P2 and P3 monitoring: English ivy was monitored on NRS FIA P2 invasive plots from 2007 through 2010 and on P3 plots from 2005 through 2006. It was the 39th most commonly observed IPS and was found on 3 of 7,107 plots (<0.1 percent; Table 2). English ivy was observed in three states: Indiana, Maryland, and Pennsylvania (Fig. 33).

Figure 32.—English ivy climbing a tree. Photo by Jil Swearingen, USDI National Park Service, Bugwood.org.

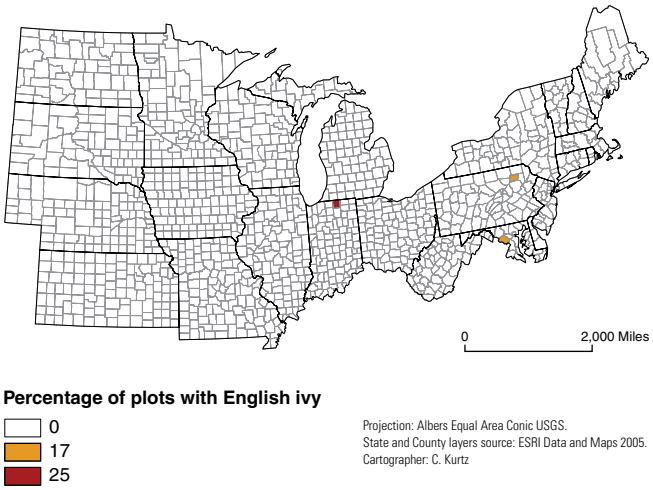

Figure 33.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2007-2010) and P3 plots (2005-2006) where English ivy was observed, by county.

European cranberrybush

(Viburnum opulus)

VIOP

Background and characteristics: European cranberrybush, also known as snowball bush, is a woody shrub of the honeysuckle family (Caprifoliaceae) that is native to Europe and is spreading across north Asia, north Africa, and North America (Velioglu et al. 2006). Growth is best in the sun with flowering reduced in part shade. It is generally found on damp soils and is planted for its ornamental value, offering attractive foliage, white flower clusters (Fig. 34), and edible glossy red fruits. European cranberrybush is also medicinally important. The berries are used for alcohol, preserves, pastries, candy, high blood pressure, heart troubles, coughs, colds, tuberculosis, shortness of breath, kidney and bladder infections, stomach pain, duodenal ulcers, and bleeding (Velioglu et al. 2006). The bark is also used for various medicinal purposes.

The USDA PLANTS Database (USDA, NRCS 2012) suggests this invasive shrub can survive to -38.0 °F and requires cold stratification, 30.0 to 50.0 inches of precipitation annually, 110 or more frost free days, pH levels between 5.2 and 7.0, and a minimum rooting depth of 14.0 inches. Additional growth limitations are its intolerance of anaerobic and coarse textured soils.

Current distribution: European cranberrybush is found in 30 states (primarily the northern half of the United States), all 10 Canadian provinces (not present in Labrador), Saint Pierre, and Miquelon (USDA, NRCS 2012).

P2 and P3 monitoring: European cranberrybush was monitored on NRS FIA P2 invasive plots from 2007 through 2010 and on P3 plots from 2005 through 2006. This invader was the 31st most commonly observed IPS, occurring on 16 of 7,107 plots (0.2 percent; Table 2). Observations of this invasive shrub occurred in nine states of the NRS FIA region (Fig. 35).

Figure 34.—European cranberrybush in flower. Photo by The Dow Gardens Archive, Dow Gardens, Bugwood.org.

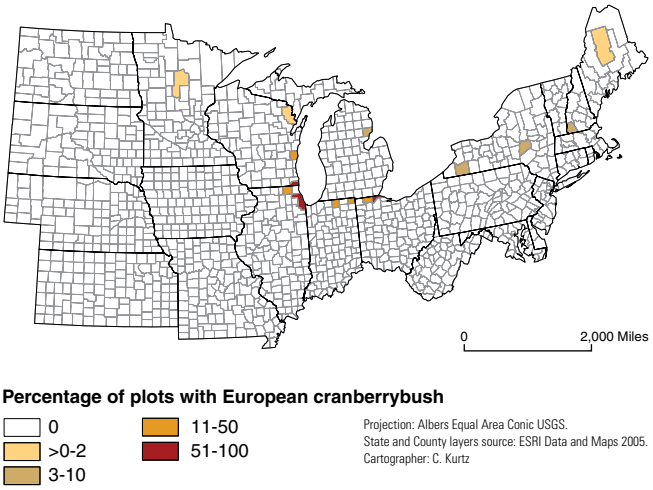

Figure 35.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2007-2010) and P3 plots (2005-2006) where European cranberrybush was observed, by county.

European privet

(Ligustrum vulgare)

LIVU

Background and characteristics: European privet, also known as common or wild privet, is a deciduous shrub of the olive family (Oleaceae) that was introduced from Europe in the mid-1800s (Miller et al. 2010). It is shade tolerant and commonly sold as topiary. In addition, this shrub is widely planted for its beauty as a hedge, displaying attractive clusters of fragrant flowers (Fig. 36) and fruits. The fruit are readily dispersed by birds and other animals, such as deer (Kaufman and Kaufman 2007).

The USDA PLANTS Database (USDA, NRCS 2012) suggests this noxious tree can survive to -38.0 °F and requires cold stratification, 18.0 to 50.0 inches of precipitation annually, 130 or more frost free days, pH levels between 5.0 and 7.5, and a minimum rooting depth of 2.0 inches. Additional growth limitations include its intolerance of anaerobic conditions and coarse textured soils.

Current distribution: European privet is now found in two Canadian provinces (British Columbia and Ontario) and 35 states in the eastern half of the United States, with Connecticut classifying this IPS as invasive (USDA, NRCS 2012). Due to the horticultural interest in this plant, many species of privet have been introduced, and distinguishing between them is difficult.

P2 and P3 monitoring: European privet was monitored on NRS FIA P2 invasive plots from 2005 through 2010 and on P3 plots from 2005 through 2006. It was the 21st most commonly observed IPS, occurring on 134 of 18,929 plots (0.7 percent; Table 2). This invader was most frequently recorded in the southeastern part of the study area (Fig. 37). European privet was present on 14.7 percent of the plots in Ohio. Eleven of the 24 states in the NRS FIA region did not have this species present.

Figure 36.—European privet in flower. Photo by Nava Tabak, Invasive Plant Atlas of New England, Bugwood.org.

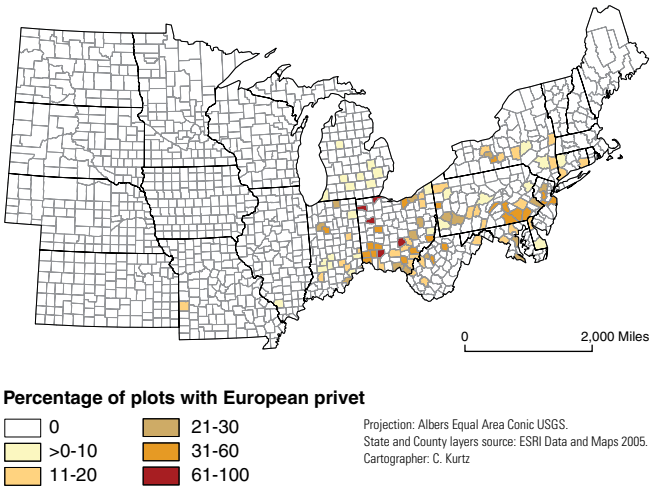

Figure 37.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2005-2010) and P3 plots (2005-2006) where European privet was observed, by county.

European swallow-wort

(Cynanchum rossicum* syn. *C. medium, Vincetoxicum medium,* and *V. rossicum)
CYRO8

Background and characteristics: European swallow-wort, also known as pale swallow-wort and dog-strangling vine, is a perennial herbaceous vine of the milkweed family (Asclepiadaceae) that was first collected in Monroe County, New York in 1897 (Sheeley and Raynal 1996). It has dainty light pink to reddish brown flowers (Fig. 38) and is planted as an ornamental. The vines of European swallow-wort can grow up to 6.0 feet long (Czarapata 2005, Kaufman and Kaufman 2007).

The effects caused by this species are concerning. This IPS may threaten at least 54 species of rare plants, insects, birds, and land snails in the globally rare alvar (i.e., shallow limestone barrens) habitats of New York's Great Lakes Basin, along with causing variable effects on the monarch populations since it may outcompete host plants such as the native common milkweed (DiTommaso and Losey 2003). DiTommaso and Losey (2003) found European swallow-wort is not a viable host species for monarch oviposition, though they mention another study that suggests it is a suitable host. Due to conflicting results, the value of European swallow-wort as a host plant for monarch oviposition is unclear.

Current distribution: European swallow-wort is a concern in many states of the NRS region. Currently it is found in three Canadian provinces (British Columbia, Ontario, and Quebec) and nine states in the eastern half of the United States, with Connecticut listing it as banned, and Massachusetts and New Hampshire listing it as a prohibited invasive species (USDA, NRCS 2012).

P2 and P3 monitoring: European swallow-wort was monitored on NRS FIA P2 invasive plots from 2007 through 2010 and on P3 plots from 2005 through 2006. It tied with Chinaberry as the 45th most commonly observed IPS and was observed on 1 of the 7,107 plots (<0.1 percent; Table 2), in New York (Fig. 39).

Figure 38.—European swallow-wort in flower. Photo by Leslie J. Mehrhoff, University of Connecticut, Bugwood.org.

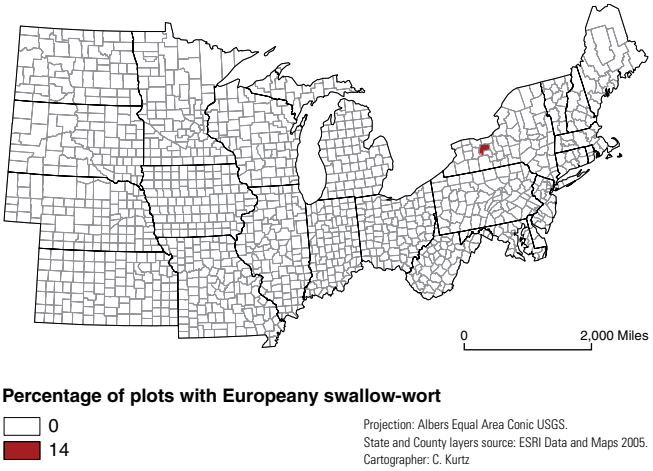

Figure 39.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2007-2010) and P3 plots (2005-2006) where European swallow-wort was observed, by county.

Garlic mustard

(Alliaria petiolata)
ALPE4

Background and characteristics: Garlic mustard is an herbaceous biennial of the mustard family (Brassicaceae). It was introduced in the mid-1800s from Europe as a food and medicinal plant and has spread throughout much of North America and Canada at a rate of 2,500 square miles per year (Rodgers et al. 2008). This herbaceous invader commonly occurs on disturbed sites. It now dominates the understory of many forests in New England and the Midwest and has become one of the most rapidly expanding woodland IPS in eastern North America (Welk et al. 2002). After only 5 to 7 years, this species can dominate the forest floor (Czarapata 2005) where its dense growth can replace spring ephemerals (Cavers et al. 1979). Contributing to its success, garlic mustard produces an abundance of small seeds that are dispersed by humans, waterways, and animal fur, feet, and feathers. The seeds remain viable in the soil up to 5 years (Bartuszevige et al. 2007).

Peculiar to this species is its ability to invade mature forests. It has a photosynthetic advantage at low irradiance (Dhillion and Anderson 1999) and outcompetes native vegetation by monopolizing the available light, nutrients, and moisture. Kurtz (2010) found the nonforest edge effect for garlic mustard was detectable much further into the forest (914.7 feet) than for the four other invasive species she studied (multiflora rose [*Rosa multiflora*], common buckthorn, nonnative bush honeysuckles, and reed canarygrass [*Phalaris arundinacea*]). However it is suggested these invasions generally occur following disturbance (Bartuszevige et al. 2007).

Garlic mustard generally establishes in deciduous woods with nonacidic, mesic soil (Welk et al. 2002) and is rarely found on xeric sites (Kurtz 2010). After establishing, garlic mustard often forms dense monocultures (Fig. 40), changing the habitat suitability for forest fauna and impacting the entire food chain. It also inhibits the growth of mycorrhizal fungi, threatening the nutrient uptake and competitive ability of native plants (Dhillion and Anderson 1999, Kaufman and Kaufman 2007, Weber and Gibson 2007).

Figure 40.—Understory invasion by garlic mustard. Photo by Leslie J. Mehrhoff, University of Connecticut, Bugwood.org.

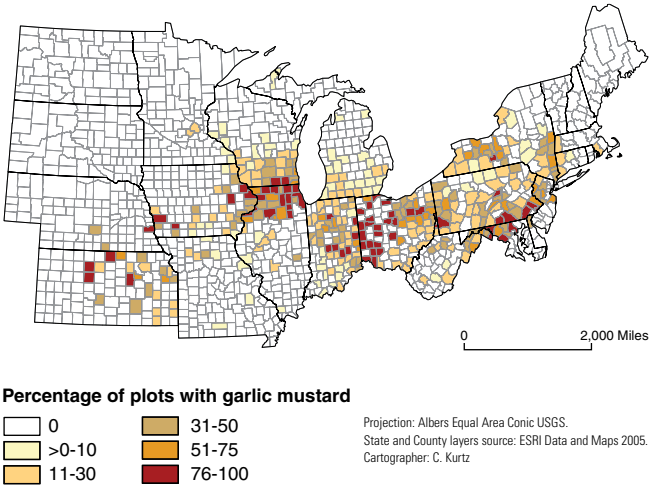

Figure 41.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2005-2010) and P3 plots (2005-2006) where garlic mustard was observed, by county.

The success of native plants is also put at risk by fauna that assist with the germination and dispersal of garlic mustard. White-tailed deer (*Odocoileus virginianus*) may contribute to the spread of garlic mustard by avoiding this aggressive invader and browsing other species, creating soil disturbances that facilitate germination (Rawinski 2008). This trend has been found in eastern hemlock (*Tsuga canadensis*) forests (Booth et al. 2010). Through changing the soil and litter layers and exposing mineral soil, the presence of nonnative earthworms may also facilitate

germination. Garlic mustard plants can displace native mustard, threatening the rare native West Virginia white butterfly (*Pieris virginiensis*). This butterfly depends on the native mustard, and due to the differing chemistry of the leaves, the larvae fail to survive on the garlic mustard plants (Kaufman and Kaufman 2007).

Aside from the negative consequences caused by this plant, it is valued as a culinary and medicinal plant. The leaves have a high vitamin A and C content and can be used for garlic in salads, sandwiches, or cooking (Cavers et al. 1979, Kaufman and Kaufman 2007). Medicinally, garlic mustard is reported to be valuable as a sudorific, deobstruent, and to treat gangrene, ulcers, and dropsy (Cavers et al. 1979).

Due to the site requirements of garlic mustard, it is climatically restricted within the NRS region. Research suggests garlic mustard requires ≥ 19.7 inches of annual rainfall, warmth during the main development (the 48.2 °F May isotherm), adequate cold winters (the 42.8 °F January isotherm and mean December, January, and February temperatures < 41.0 °F), and sufficient time for plant development (the isoline of > 120 frost free days) (Welk et al. 2002). Booth et al. (2010) also similarly suggest garlic mustard has a northern limit defined by sufficiently warm springs and summers and winters that are not too cold, as well as being restricted by soil type since garlic mustard occurs outside the acidic boreal soils. Research by Moser et al. (2009) further supports the influence of climate by noting a considerable reduction in the presence of garlic mustard north of 44.0° N latitude, which is also suggested by Figure 41.

In the future, garlic mustard may become an extremely troublesome weed. As the climate changes, garlic mustard may adapt more readily than most plant species since it does not require a specific morphological stage to respond to favorable conditions (Booth et al. 2010), and the flowers open earlier with increasing temperature (Welk et al. 2002).

Current distribution: Currently garlic mustard is found in 36 states, and 8 states classify it as banned, prohibited, quarantine, or noxious. It is also found in five Canadian provinces: British Columbia, New Brunswick, Nova Scotia, Ontario, and Quebec (USDA, NRCS 2012).

P2 and P3 monitoring: Garlic mustard was monitored on NRS FIA P2 invasive plots from 2005 through 2010 and on P3 plots from 2005 through 2006. In the region, it was the third most commonly observed IPS, occurring on 851 of the 18,929 plots (4.5 percent; Table 2). Garlic mustard was most abundant on plots in the states of Ohio (30.0 percent), Maryland (27.0 percent), Pennsylvania (22.0 percent), and New Jersey (20.0 percent). Due to its abundance across the NRS region, it ranked among the five most frequently observed IPS monitored on FIA plots in 12 states (Table 3). Garlic mustard was not detected in six states of the NRS FIA region: Maine, New Hampshire, North Dakota, Rhode Island, South Dakota, and Vermont (Fig. 41).

Giant knotweed

(Polygonum sachalinense* syn. *Fallopia sachalinensis; Reynoutria sachalinensis)
POSA4

Background and characteristics: Giant knotweed is an herbaceous perennial of the buckwheat family (Polygonaceae) that grows in sun to part shade. It was introduced in the second half of the 19th century to Europe from Japan and in the late 19th century to North America as an ornamental and for fodder (Urgenson et al. 2009). Floristic records in the northwestern United States suggest this IPS, along with Bohemian and Japanese knotweed, are among the most rapidly spreading plant invaders (Urgenson et al. 2009). Humans have facilitated the spread of this species by planting it in gardens where they enjoy the white flowers (Fig. 42). Another important spread mechanism is flood waters which transport rhizome fragments (Urgenson et al. 2009).

Where this plant establishes, it creates dense mats that can outcompete neighboring plants and impede photosynthesis, making it difficult for other species to survive. Urgenson et al. (2009) found that this plant has the ability to alter the structure and function of riparian forests due to its high rate of resorption of foliar nitrogen which results in less nitrogen being added to the soil.

Current distribution: Giant knotweed is found in seven Canadian provinces (British Columbia, New Brunswick, Newfoundland, Nova Scotia, Ontario, Prince Edward Island, and Quebec) and 27 states, with California, Oregon, and Washington listing this invader as noxious and Connecticut as potentially invasive, banned (USDA, NRCS 2012).

P2 and P3 monitoring: Giant knotweed was monitored on NRS FIA P2 invasive plots from 2007 through 2010 and on P3 plots from 2005 through 2006. It was the 38th most commonly observed IPS, occurring on 4 of the 7,107 plots (0.1 percent; Table 2). Giant knotweed was observed in Michigan, Pennsylvania, and West Virginia (Fig. 43).

Figure 42.—Giant knotweed in flower. Photo by Jan Samanek, State Phytosanitary Administration, Bugwood.org.

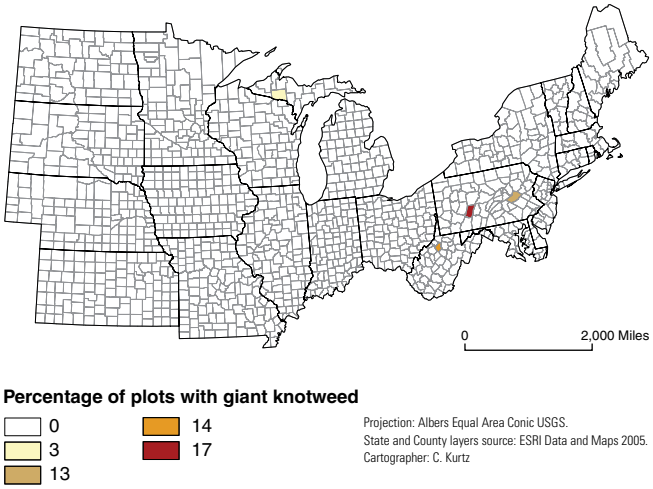

Figure 43.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2007-2010) and P3 plots (2005-2006) where giant knotweed was observed, by county.

Glossy buckthorn

(Frangula alnus)
FRAL4

Background and characteristics: Glossy buckthorn, a woody shrub of the buckthorn family (Rhamnaceae), was introduced to the United States from Eurasia in the mid-1800s for ornamental use and is now naturalized in the northeastern United States and southeastern Canada (Gassmann et al. 2008). A successful invader, glossy buckthorn is very adaptable and can grow in full sun or shade. It is problematic in wet areas but can also grow on upland sites (Czarapata 2005, Kaufman and Kaufman 2007). Interest in this plant for landscaping is primarily due to its form. Glossy buckthorn is sold as a hedge offering showy, glossy leaves and attractive berries (Fig. 44). The numerous berries are readily transported by small animals and birds. In birds, the berries have a laxative effect (Czarapata 2005). Deer may also contribute to the spread of glossy buckthorn since they do not browse this noxious shrub and instead browse other plant species, creating soil disturbances that facilitate germination (Rawinski 2008). Federal agencies promoted planting this IPS (Zouhar et al. 2008) which has also contributed to its spread. Some cultures have found this invader useful for making dyes and as a medicinal plant (Gould and Stuckey 1992).

Glossy buckthorn's presence (Fig. 45) is similar to that of common buckthorn (Fig. 25) with reduced presence south of 42° N. According to the Plants Database (USDA, NRCS 2012), it is suggested glossy buckthorn can survive to -38.0 °F and requires cold stratification, 35.0 to 60.0 inches of precipitation annually, 90 or more frost free days, pH levels between 5.0 and 6.5, and a minimum rooting depth of 14.0 inches. Additional growth limitations are its intolerance of anaerobic conditions and low tolerance of calcareous soils.

Current distribution: In the United States, glossy buckthorn is found in 24 states with 5 listing it as noxious, prohibited, or invasive. In Canada it is found in seven provinces: Manitoba, New Brunswick, Nova Scotia, Ontario, Prince Edward Island, Quebec, and Saskatchewan (USDA, NRCS 2012).

P2 and P3 monitoring: Glossy buckthorn was monitored on NRS FIA P2 invasive plots from 2005 through 2010 and on P3 plots from 2005 through 2006. It was the 19th most commonly observed IPS, occurring on 197 of 18,929 plots (1.0 percent; Table 2). This invasive shrub ranked among the five most commonly observed IPS in four states (Maine, Massachusetts, New Hampshire, and Rhode Island) and was the most commonly observed IPS in New Hampshire (Table 3). Its distribution is primarily in the northern part of the NRS region. Of the 24 states monitored, Massachusetts and Rhode Island had the highest proportion of forested plots with this IPS at 17.0 and 12.1 percent, respectively. Ten of the 24 states of the NRS region did not have glossy buckthorn present on FIA plots.

Figure 44.—Glossy buckthorn with fruit. Photo by Leslie J. Mehrhoff, University of Connecticut, Bugwood.org.

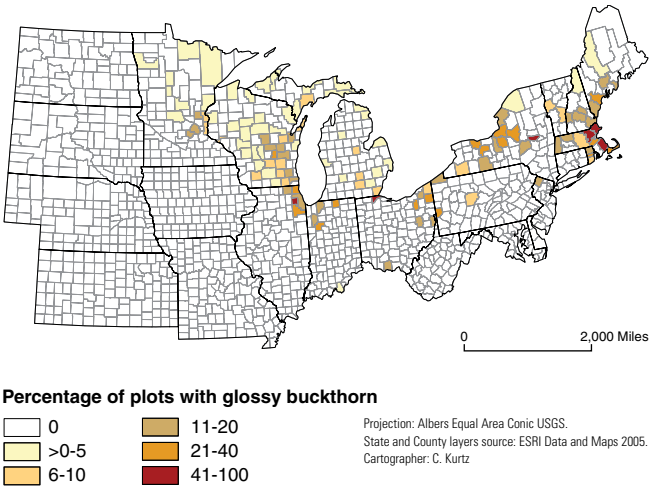

Figure 45.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2005-2010) and P3 plots (2005-2006) where glossy buckthorn was observed, by county.

Japanese barberry

(Berberis thunbergii)

CIVU

Background and characteristics: Japanese barberry, a shrub of the barberry family (Berberidaceae), was sent from Russia to Boston in 1875 as a substitute for common barberry which harbors black stem rust (*Puccinia graminis*), affecting barley and wheat plants (Kaufman and Kaufman 2007). As a landscape plant, Japanese barberry is highly desired because of its drought resistance and attractive fruit and foliage (Fig. 46). Due to its horticultural value, several ornamental cultivars have been released. This species can survive across a broad range of light levels, but when grown in the shade, the color of its foliage is not as vibrant.

As an aggressive spreading shrub, Japanese barberry has several important spread mechanisms. Birds are an important vector of the seeds (Kaufman and Kaufman 2007). Deer may also promote the presence of Japanese barberry since they do not browse this plant but instead browse other species, creating soil disturbances which facilitate germination (Rawinski 2008). This trend was found in an eastern hemlock forest where deer accelerated invasion by Japanese barberry (Booth et al. 2010). Japanese barberry also spreads through vegetative propagales and from rooting where the branches contact the soil. By spreading vegetatively, this invasive can form a dense shrub layer that impedes the growth of other species and is a nuisance to humans and animals since the plants are covered with spines. An additional negative impact caused by these plants is the alteration of the soil chemistry. Research suggests this IPS can change soil pH and nitrate levels, favoring its growth over other plants (Boos et al. 2010).

Though tolerant of a wide variety of conditions, Japanese barberry does have some specific requirements. According to the Plants Database (USDA, NRCS 2012), it is suggested this noxious shrub can survive to -28.0 °F and requires 30.0 to 60.0 inches of precipitation annually, 180 or more frost free days, pH levels between 5.5 and 7.2, and a minimum rooting depth of 18.0 inches. Additional limits to its presence are its intolerance of anaerobic and calcareous soils as well as its cold stratification requirement.

Current distribution: Federal agencies promoted planting this species (Zouhar et al. 2008), and its aggressive growth and spread have contributed to the presence of this IPS throughout the United States. Japanese barberry is now found in 31 states, primarily in the Northeast and Midwest, with Connecticut listing it as invasive and Massachusetts as prohibited; it is also found in five provinces: New Brunswick, Nova Scotia, Ontario, Prince Edward Island, and Quebec (USDA, NRCS 2012).

Figure 46.—Japanese barberry. Photo by Cassandra Kurtz, U.S. Forest Service.

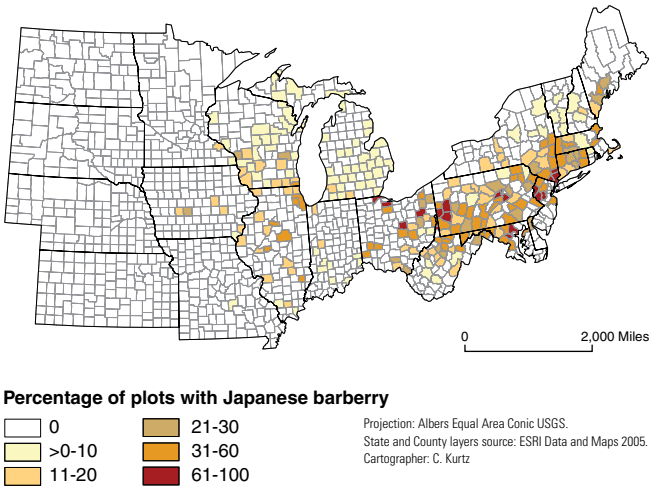

Figure 47.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2005-2010) and P3 plots (2005-2006) where Japanese barberry was observed, by county.

P2 and P3 monitoring: Japanese barberry was monitored on NRS FIA P2 invasive plots from 2005 through 2010 and on P3 plots from 2005 through 2006. It was the 12th most commonly observed IPS, occurring on 458 of the 18,929 plots (2.4 percent; Table 2). The highest percent of plots with Japanese barberry present was in Connecticut (32.8 percent). All states with greater than 10.0 percent of their plots having this IPS present were in the eastern part of the region (Table 2). Its regional occurrence is shown in Figure 47. Japanese barberry was not detected in four NRS FIA states of the Great Plains region: Kansas, Nebraska, North Dakota, and South Dakota.

Japanese honeysuckle

(Lonicera japonica)

LOJA

Background and characteristics: Japanese honeysuckle is a woody vine (Fig. 48) of the honeysuckle family (Caprifoliaceae). It is used as a groundcover and ornamental, introduced from Japan in 1806 (Smith 1997). Its ornamental value is due to the prolific fragrant flowers and dense, rapid growth. Japanese honeysuckle is a shade tolerant vine that can grow to 30.0 feet or more (Czarapata 2005). This IPS climbs on vegetation, where it can impact photosynthesis of other plants and break or girdle stems. Its vines increase the surface area of trees, escalating the probability of blow down. There is also increased fire risk from Japanese honeysuckle because of the increased fuel load and the likelihood of a crown fire due to the fuel continuity created by the plant growing up and over forest vegetation (Zouhar et al. 2008).

Aside from its ecological impacts, Japanese honeysuckle has important medicinal uses. Honeysuckle is drank as a tea and is traditionally used for dysentery, coughs, fevers, enteritis, laryngitis, colds, flu, rheumatism, sores, tumors (especially breast cancer), infected boils, scabies, and swelling. Experimentally it has been shown to make tuberculosis static, be antiviral, antibacterial, and lower cholesterol (Foster and Duke 2000).

In the NRS region, Japanese honeysuckle is climatically restricted. According to the Plants Database (USDA, NRCS 2012), it is suggested this noxious vine can survive to -13.0 °F and requires cold stratification, 24.0 to 60.0 inches of precipitation annually, 130 or more frost free days, pH levels between 4.9 and 7.8, and a minimum rooting depth of 10.0 inches. Factors restricting the presence of Japanese honeysuckle are its intolerance of salinity, the presence of coarse and calcareous soils (USDA, NRCS 2012), and deep shade (Smith 1997).

Current distribution: Since its introduction in 1806, Japanese honeysuckle has spread to one Canadian province (Ontario), Puerto Rico, and 38 states, with 4 northeastern states (Connecticut, Massachusetts, New Hampshire, and Vermont) classifying it as banned, prohibited, or noxious (USDA, NRCS 2012).

Figure 48.—Japanese honeysuckle vine growing on a fence. Photo by Charles T. Bryson, USDA Agricultural Research Service, Bugwood.org.

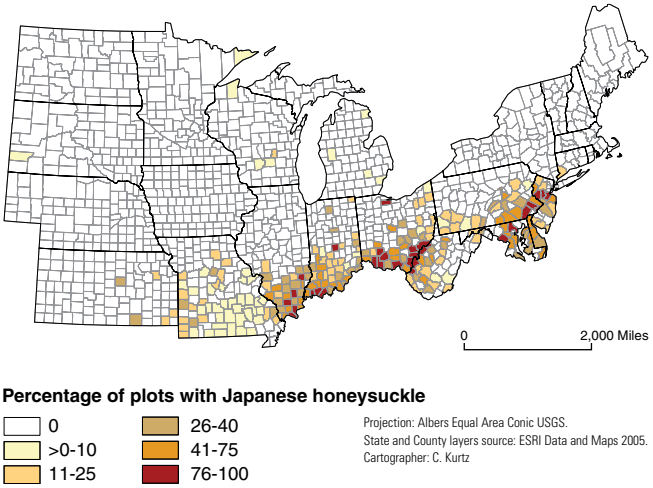

Figure 49.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2005-2010) and P3 plots (2005-2006) where Japanese honeysuckle was observed, by county.

P2 and P3 monitoring: Japanese honeysuckle was monitored on NRS FIA P2 invasive plots from 2005 through 2010 and on P3 plots from 2005 through 2006. It was the sixth most commonly observed IPS, occurring on 687 of the 18,929 plots (3.6 percent; Table 2). Within the region, Japanese honeysuckle ranked among the five most frequently recorded IPS in seven states (Delaware, Illinois, Indiana, Maryland, Missouri, New Jersey, and Ohio) and was the most commonly observed invasive in Delaware (40.5 percent of forested plots) and Maryland (38.6 percent of forested plots) (Table 3). Japanese honeysuckle was primarily found in the southern part of the region and was not detected on FIA plots in nine states of the NRS region (Fig. 49).

Japanese knotweed

(Polygonum cuspidatum* syn. *Fallopia cuspidatum, Reynoutria cuspidatum)
POCU6

Background and characteristics: Japanese knotweed, also known as Mexican bamboo, is an herbaceous perennial of the buckwheat family (Polygonaceae). It is native to eastern Asia and was introduced in the late 1800s to the United States from Japan, via the United Kingdom, for fodder, erosion control, and ornamental use (Czarapata 2005, Gould and Stuckey 1992, Kaufman and Kaufman 2007). Optimal growth occurs in full sun though it is tolerant of shade as well as drought, salinity, and high temperatures (Brakke 2006, Kaufman and Kaufman 2007). Japanese knotweed is frequently found along right-of-ways and near homesteads where the long, arching branches with sprays of flowers (Fig. 50) are visible. The stems of this IPS are unique in that they are bamboo-like with raised nodes. These distinctive stems are reported to be edible when young (Kaufman and Kaufman 2007, Peterson 1977) and the somewhat older stems can be made into jam (Peterson 1977). Allowed to grow, the plants can reach up to 10.0 feet (Kaufman and Kaufman 2007).

An aggressive spreading species, the presence of Japanese knotweed is a concern. Japanese knotweed is difficult to control and can damage pavement by sending rhizomes underneath highways from one side of the road to the other. The stems can even penetrate asphalt (Gould and Stuckey 1992). Japanese knotweed is also worrisome along railroads because when dormant it poses a fire hazard (Czarapata 2005).

Current distribution: Since its introduction in the late 1800s, this herbaceous perennial has spread to eight Canadian provinces (not present in Alberta, Saskatchewan, and Labrador), Saint Pierre, Miquelon, and 41 states, with 8 states listing it as noxious, prohibited, or invasive (USDA, NRCS 2012).

P2 and P3 monitoring: Japanese knotweed was monitored on NRS FIA P2 invasive plots from 2005 through 2010 and on P3 plots from 2005 through 2006. It was the 35th most commonly observed IPS, occurring on 26 of 18,929 plots (0.1 percent; Table 2), and was observed in 15 states of the NRS FIA region (Fig. 51).

Figure 50.—Japanese knotweed in flower. Photo by Jan Samanek, State Phytosanitary Administration, Bugwood.org.

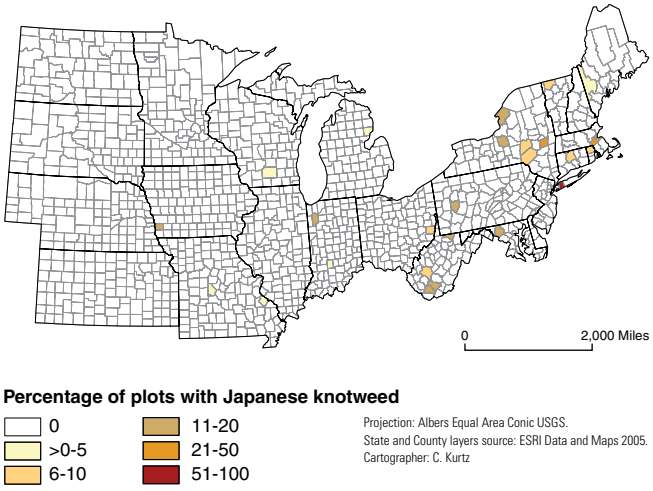

Figure 51.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2005-2010) and P3 plots (2005-2006) where Japanese knotweed was observed, by county.

Japanese meadowsweet

(Spiraea japonica)
SPJA

Background and characteristics: Japanese meadowsweet, also known as Japanese spiraea, is a woody shrub of the rose family (Rosaceae) that was introduced around 1870 to the northeastern United States as an ornamental from Asia (Kaufman and Kaufman 2007). It is still widely available from nurseries and is a popular plant since it is low-maintenance and has attractive form, foliage, and flowers (Fig. 52). The popularity of Japanese meadowsweet as a landscape plant has resulted in the introduction of several cultivars. Japanese meadowsweet spreads from those areas where it is planted and forms dense shrub layers that shade out understory plants. Primary means of spread are by wind, water, and vegetative propagules where it often invades disturbed sites; these traits may enable Japanese meadowsweet to be a serious invasive plant in the future (Martine et al. 2008).

According to the PLANTS Database (USDA, NRCS 2012), it is suggested that Japanese meadowsweet can survive to -23.0 °F and requires 35.0 to 60.0 inches of precipitation annually, 145 or more frost free days, pH levels between 5.0 and 6.8, and a minimum rooting depth of 14.0 inches. Additional growth limitations are its intermediate shade tolerance and intolerance of anaerobic and calcareous soils.

Current distribution: Japanese meadowsweet occurs in 21 states, primarily in the eastern half of the United States, and two Canadian provinces, Nova Scotia and Ontario (USDA, NRCS 2012).

P2 and P3 monitoring: Japanese meadowsweet was monitored on NRS FIA P2 invasive plots from 2007 through 2010 and on P3 plots from 2005 through 2006. It was the 32nd most commonly observed IPS, occurring on 12 of 7,107 plots (0.2 percent; Table 2). This invasive shrub was observed in four states: Indiana, New York, Pennsylvania, and West Virginia (Fig. 53). The highest percentage of plots with Japanese meadowsweet present occurred in West Virginia (seven plots; 2.1 percent).

Figure 52.—Japanese meadowsweet 'Little Princess' in flower. Photo by Cassandra Kurtz, U.S. Forest Service.

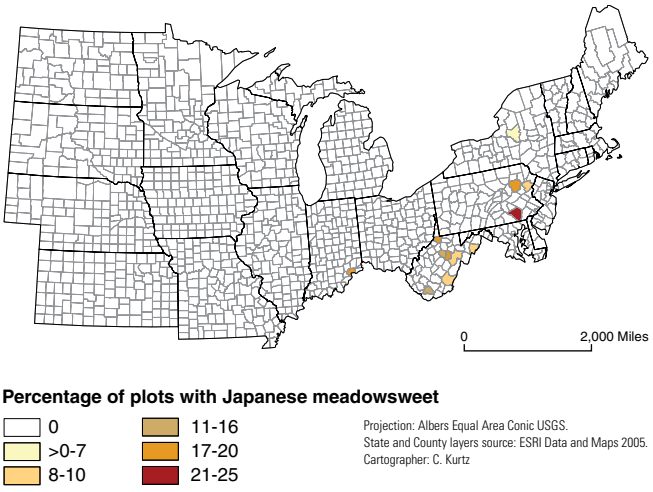

Figure 53.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2007-2010) and P3 plots (2005-2006) where Japanese meadowsweet was observed, by county.

Kudzu

(Pueraria montana)
PUMO

Background and characteristics: Kudzu is a perennial, semi-woody vine of the pea family (Fabaceae). It was brought to the United States from Japan in 1876 during the Centennial Exposition in Philadelphia, PA from the Japanese government's garden of native plants (Kaufman and Kaufman 2007, Shurtleff and Aoyagi 1977). After its introduction, kudzu became a highly desired legume with beautiful fragrant flowers, quick growth, and lush foliage. Optimal growth occurs in full sun and its seeds are generally not viable, so spread is primarily through vegetative propagules. This drought tolerant vine is able to grow 6.0 inches in a day and has a massive root system that is able to penetrate 10.0 feet into the ground and can weigh over 100.0 pounds (Kaufman and Kaufman 2007). Kudzu's deep roots can penetrate beneath depleted surface soil and send minerals up to the leaves, giving it a nutritional value equal to clover and alfalfa (Shurtleff and Aoyagi 1977).

After discovering the nutritional value and rapid growth rate of kudzu, widespread planting occurred. In the 1930s unprofitable red clay soils were abandoned in the South, and government crews planted thousands of acres for erosion control (Kaufman and Kaufman 2007). In the 1940s the government encouraged farmers to plant kudzu, offering $8.00 per acre to plant it in fields (Kaufman and Kaufman 2007). After decades of planting this species as an ornamental and for forage, the U.S. Department of Agriculture removed it from its approved cover crops in 1953 (Kaufman and Kaufman 2007). Other countries have also experimented with growing kudzu. Brazil imported this IPS for apiaries and suggested that the honey is of highest quality, delightful in fragrance and flavor (Shurtleff and Aoyagi 1977).

Kudzu is estimated to be spreading at a rate of 124,000 acres per year and has infested 7.0 million acres of land (Kaufman and Kaufman 2007, Pappert et al. 2000). The aggressive growth of kudzu (Fig. 54) can impede photosynthesis, increase the likelihood of stem breakage, and girdle trees. Its vines can grow to over 100.0 feet (Kaufman and Kaufman 2007). The vines have important fire implications due to increasing fuel continuity by growing up and over forest vegetation which can potentially increase the fuel load and likelihood of a crown fire (Zouhar et al. 2008).

Medicinally kudzu is an important plant. The Chinese have been using it for herbal medicine for over 2,000 years, and the Japanese make a starch from the roots which is thought to have an effect on prostate health and some cancers (Kaufman and Kaufman 2007). Kudzu has also been reported to be valuable for headaches, diarrhea, dysentery, intestinal obstruction, gastroenteritis, measles, sores, swellings, mastitis, sore throats, deafness, to sober an intoxicated person, and induce sweating, as well as experimentally to lower blood sugar and pressure, prevent the development of tumors, and stimulate liver tissue regeneration while protecting against liver toxins (Foster and Duke 2000). Furthermore teas, jellies, and syrups are made from this invader (Kaufman and Kaufman 2007).

Figure 54.—Kudzu infestation. Photo by James H. Miller, USDA Forest Service, Bugwood.org.

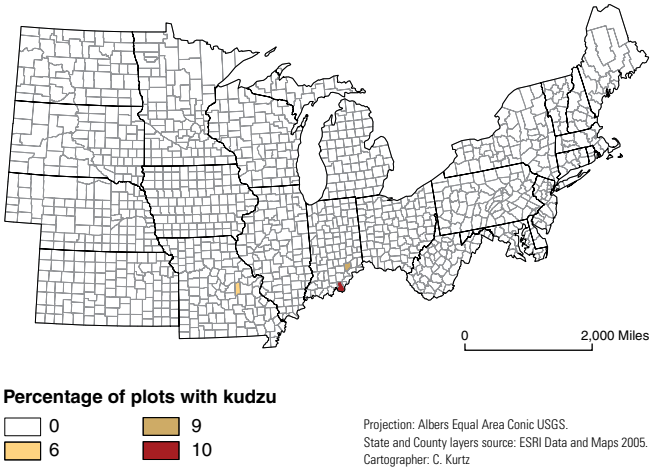

Figure 55.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2005-2006) and P3 plots (2005-2010) where kudzu was observed, by county.

Current distribution: Kudzu is recorded in 30 states (USDA NRCS 2011).

P2 and P3 monitoring: Kudzu was monitored on NRS FIA P2 invasive plots from 2005 through 2006 and on P3 plots from 2005 through 2010. It tied with Asiatic tearthumb as the 42nd most commonly observed IPS, occurring on 3 of 13,659 plots (<0.1 percent; Table 2). Kudzu was observed in two NRS states (Fig. 55): Indiana (two plots) and Missouri (one plot).

Leafy spurge

(Euphorbia esula)

EUES

Background and characteristic: Leafy spurge, an herbaceous perennial of the spurge family (Euphorbiaceae), is from the Caucaus region of western Asia and was introduced as a seed impurity to Newbury, Massachusetts in 1827 (Kaufman and Kaufman 2007, Nature Conservancy 1996, Royer and Dickinson 1999, Westbrooks 1998). It is a major concern throughout the United States, causing huge economic impacts by reducing agricultural potential, wildlife quality, plant diversity, and aesthetic value. An additional concern with leafy spurge is that it may be allelopathic, producing allelochemicals that interfere with the growth of other plants (Czarapata 2005, Royer and Dickinson 1999).

Leafy spurge is spread by seeds that are expelled from a capsule up to 15.0 feet and can float along waterways, as well as by the roots which extend up to 21.0 feet (Kaufman and Kaufman 2007). Where the plants establish, their dense growth can shade out neighboring vegetation (Fig. 56). Its negative effects are so great that it ranks among The Nature Conservancy's "Dirty Dozen" alien species (Nature Conservancy 1996).

Leafy spurge is especially problematic in agricultural areas and causes economic strife to ranchers. Sheep are able to graze this noxious invader without harmful effects (Royer and Dickinson 1999). However, cattle will not graze an area with as little as 10.0 percent leafy spurge cover as the milky sap irritates their digestive tract and causes lesions around their eyes and mouths (Westbrooks 1998). Through reducing annual livestock revenue by decreasing the grazing capacity in four western states (Montana, North Dakota, South Dakota, and Wyoming), infestations by this IPS have resulted in a loss of approximately 1,433 jobs and $129 million in direct and secondary economic impacts (Czarapata 2005).

An example of the economic toll caused by leafy spurge is in Kalmath County, OR where a 1,360 acre ranch was abandoned because of the lost productivity from this plant; the ranch eventually sold for $22.00 an acre, 83.0 percent less than the value of similar noninfested land that was valued from $125.00 to $150.00 per acre (Czarapata 2005, Westbrooks 1998). The estimate to control the leafy spurge on this ranch was $65,000, but the new owner spent substantially more than that, making practically no headway (Westbrooks 1998).

Further impacts caused by this species are noted in North Dakota where leafy spurge has infested over 1.2 million acres of rangeland estimated at an annual loss of nearly $75 million (Czarapata 2005). A previous annual estimate of the direct and secondary impacts of this perennial on grazing land, wildlife, and the state's economy was over $87 million (Westbrooks 1998).

Figure 56.—Leafy spurge. Photo by Cassandra Kurtz, U.S. Forest Service.

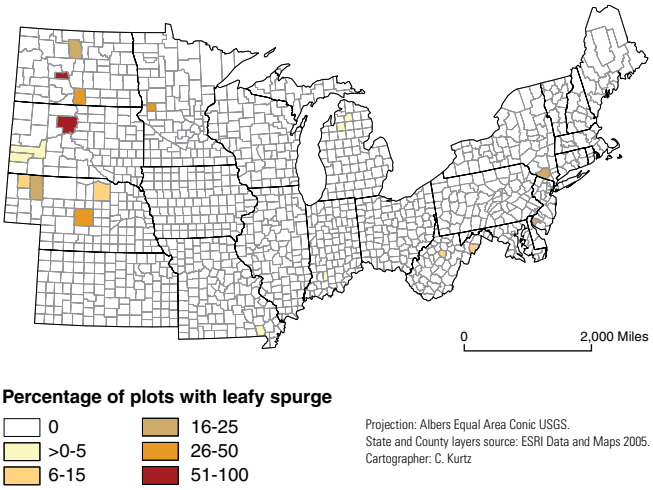

Figure 57.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2005-2010) and P3 plots (2005-2006) where leafy spurge was observed, by county.

Current distribution: Overall, the United States and southern Canada have more than 5 million acres invaded by leafy spurge (Kaufman and Kaufman 2007). This herbaceous invader is currently found in nine Canadian provinces (not present in Labrador and Newfoundland), the Yukon Territory, and 35 states (all of the lower 48 except the South/Southeast and Delaware), with 22 states listing leafy spurge as noxious, banned, or prohibited (USDA, NRCS 2012).

P2 and P3 monitoring: Leafy spurge was monitored on NRS FIA P2 invasive plots from 2005 through 2010 and on P3 plots from 2005 through 2006. It was the 36th most commonly observed IPS, occurring on 21 of 18,929 plots (0.1 percent; Table 2), and was observed in 10 states of the NRS FIA region. There were no observances on plots in the Northeastern part of the region (Fig. 57).

Lesser burdock

(Arctium minus)
ARMI2

Background and characteristics: Lesser burdock, also known as common burdock and wild rhubarb, is a member of the aster family (Asteraceae) and is a common agriculture weed from northern Europe, first reported in New England in 1638 (Royer and Dickinson 1999). This plant is an herbaceous biennial, generally found in full sun, though it will tolerate some shade. It can live in acidic to alkaline conditions and prefers to grow in moist, well drained soils (Kaufman and Kaufman 2007). In poor conditions lesser burdock may live 4 years before it flowers and dies (Czarapata 2005, Kaufman and Kaufman 2007). The flowers are known to attract various butterflies and birds; however the sticky seed bracts can be detrimental to some species such as hummingbirds.

Lesser burdock is spread by seed. Each plant is capable of producing over 10,000 seeds (Kaufman and Kaufman 2007, Royer and Dickinson 1999). The seeds are dispersed by humans and animals that come in contact with the plant since the bracts of the burs (Fig. 58) readily attach to clothes and fur. Lesser burdock is generally found along forest edges where it receives adequate light and shades native plant species.

Aside from the negative impacts caused by lesser burdock, this plant does have many beneficial medicinal purposes and is used extensively by American Indians (Foster and Duke 2000). A root tea has traditionally been used to purify the blood, stimulate bile secretion, for digestion and sweating, as a diuretic, and against rheumatism, gonorrhea, diabetes, gout, and liver and kidney ailments. Additional medicinal values have been found in the root, leafy branches, seeds, and plant juice. The root is antibacterial, the leafy branches are used for vertigo, measles, rheumatism, hives, burns, ulcers, sores, and eczema, the seeds are used for abscesses, bruises, sore throats, insect and snake bites, flu, constipation, scarlet fever, smallpox, and scrofula, and the plant juice protects against chromosome aberrations. Japanese studies imply the roots have compounds that may curb mutations, possibly cancer. The root of this invasive plant is frequently sold in natural food stores and is popular in many Asian dishes. This IPS is also used for coffee, potherbs, and paper (Kaufman and Kaufman 2007).

Current distribution: This IPS is now found in 47 states (not recorded in Alaska, Florida, and Hawaii) with Colorado and Wyoming listing it as a noxious weed. Lesser burdock is also found in all 10 Canadian provinces (not present in Labrador), Greenland, Saint Pierre, and Miquelon (USDA, NRCS 2012).

Figure 58.—Lesser burdock with last years seed heads. Photo by Cassandra Kurtz, U.S. Forest Service.

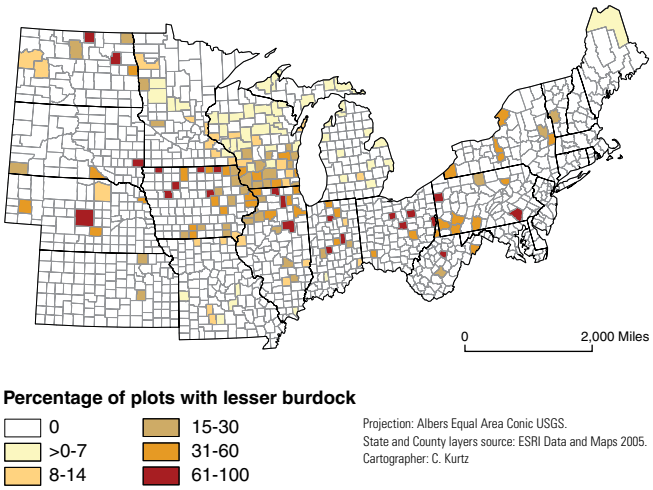

Figure 59.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2005-2006) and P3 plots (2005-2010) where lesser burdock was observed, by county.

P2 and P3 monitoring: Lesser burdock was monitored on NRS FIA P2 invasive plots from 2005 through 2006 and on P3 plots from 2005 through 2010. It was the 13th most commonly observed IPS, occurring on 304 of 13,659 plots (2.2 percent; Table 2). This herbaceous weed ranked among the five most commonly observed IPS in five states (Table 3) of the NRS FIA region: Iowa, Nebraska, North Dakota, South Dakota, and Wisconsin. The states with the highest percentage of plots containing lesser burdock were in Iowa and North Dakota at 14.3 and 13.5 percent, respectively. Figure 59 reflects this increased occurrence in the Midwest, showing a band of increased presence along the highly fragmented prairie tension zone. Lesser burdock was not detected on P2 invasive plots in seven states: Connecticut, Delaware, Maryland, Massachusetts, New Hampshire, New Jersey, and Rhode Island.

Louise's swallow-wort

(Cynanchum louiseae)
CYLO11

Background and characteristics: Louise's swallow-wort, also known as Louis swallow-wort and black swallow-wort, is an herbaceous perennial vine of the milkweed family (Asclepiadaceae). It is native to Western Europe and was introduced to Ipswich, Massachusetts as an ornamental in 1854 (Kaufman and Kaufman 2007). The plant has dainty dark purple to nearly black flowers (Fig. 60).

Louise's swallow-wort can persist in sun or shade and threatens rare lichens, moss, and other plant communities growing on thin soils over bedrock (Kaufman and Kaufman 2007). Since Louise's swallow-wort is a member of the milkweed family, it is of concern because monarch butterflies (*Danaus plexippus*) oviposit their eggs on the plants, and mortality is increased compared to laying their eggs on native milkweed (*Asclepias syriaca*) (Boos et al. 2010, Czarapata 2005, Kaufman and Kaufman 2007). The presence of grassland birds also declines when Louise's swallow-wort invades their habitat (Boos et al. 2010, Kaufman and Kaufman 2007).

This herbaceous perennial is a nuisance due to several troublesome traits. It spreads by seed (2,000 seeds per square yard) as well as from underground rhizomes (Kaufman and Kaufman 2007). Deer may increase the establishment of Louise's swallow-wort since they do not browse it and instead browse other species, creating soil disturbance which facilitates germination of the swallow-wort seed (Rawinski 2008). Once the plant establishes, it can grow to 6.0 feet long (Czarapata 2005, Kaufman and Kaufman 2007). As the stems grow, they can become difficult to traverse, hence its name "dog-strangling vine". The dense thickets (Fig. 61) reduce the vigor and photosynthetic ability of the host plant.

Current distribution: Louise's swallow-wort is found throughout the NRS region. Currently the USDA PLANTS Database (USDA, NRCS 2012) shows its presence in two Canadian provinces (Ontario and Quebec) and 21 states, with Connecticut listing it as invasive and banned, Massachusetts and New Hampshire as prohibited, and Vermont as noxious.

P2 and P3 monitoring: Louise's swallow-wort was monitored on NRS FIA P2 invasive plots from 2005 through 2010 and on P3 plots from 2005 through 2006. It was the 43rd most commonly observed IPS, occurring on 4 of 18,929 plots (<0.1 percent; Table 2). This species was observed in three states, Massachusetts, New York, and Wisconsin (Fig. 62).

Figure 60.—Louise's swallow-wort in flower. Photo by Leslie J. Mehrhoff, University of Connecticut, Bugwood.org.

Figure 61.—Louise's swallow-wort infestation. Photo by Leslie J. Mehrhoff, University of Connecticut, Bugwood.org.

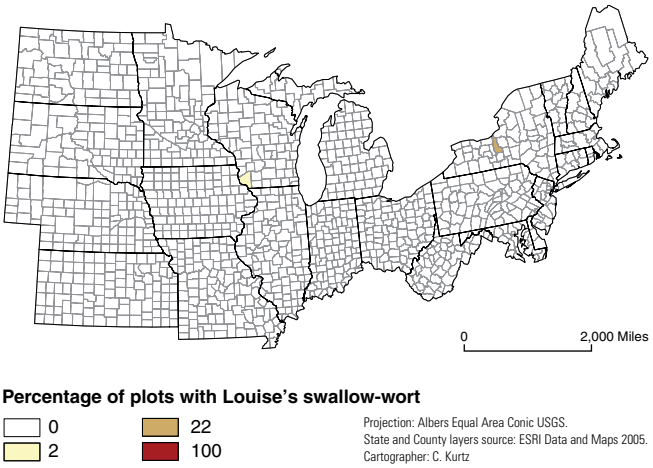

Figure 62.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2005-2010) and P3 plots (2005-2006) where Louise's swallow-wort was observed, by county.

Marsh thistle

(Cirsium palustre)
CIPA6

Background and characteristics: Marsh thistle, an herbaceous species of the aster family (Asteraceae), was introduced in the early 20th century from Europe (Tohver 1998). This weed is an aggressive invader of moist, acidic soils and disturbed areas where it is frequently dispersed by water, wind, or birds (Cao 2011). It is an unwelcome plant because of its invasive tendencies and spiny leaves and stem (Fig. 63).

Marsh thistle grows optimally in full sun and is well adapted to cold weather, growing nearly to the Arctic Circle. Its rapid spread and hybridization with Canada thistle (*Cirsium arvense*) threaten plant communities throughout the range it invades (Cao 2011).

Current distribution: Currently the USDA PLANTS Database (USDA, NRCS 2012) shows marsh thistle in five Canadian provinces (British Columbia, Newfoundland, Nova Scotia, Ontario, and Quebec), Saint Pierre, Miquelon, and five states (Massachusetts, Michigan, New Hampshire, New York, and Wisconsin), with Arkansas and Iowa classifying it as a noxious weed.

P2 and P3 monitoring: Marsh thistle was monitored on NRS FIA P2 invasive plots from 2005 through 2006 and on P3 plots from 2005 through 2010. It was the 27th most commonly observed IPS, occurring on 49 of 13,659 plots (0.4 percent; Table 2). Marsh thistle was found in three Midwestern states (Michigan, Minnesota, and Wisconsin; Fig. 64) with the highest percentage of observances in Michigan (1.1 percent).

Figure 63.—Detailed drawing of marsh thistle. Photo by Britton, N.L. and A. Brown. 1913. An illustrated flora of the northern United States, Canada and the British Possessions. 3 vols. Charles Scribner's Sons, New York. Vol. 3: 554, USDA-NRCS PLANTS Database.

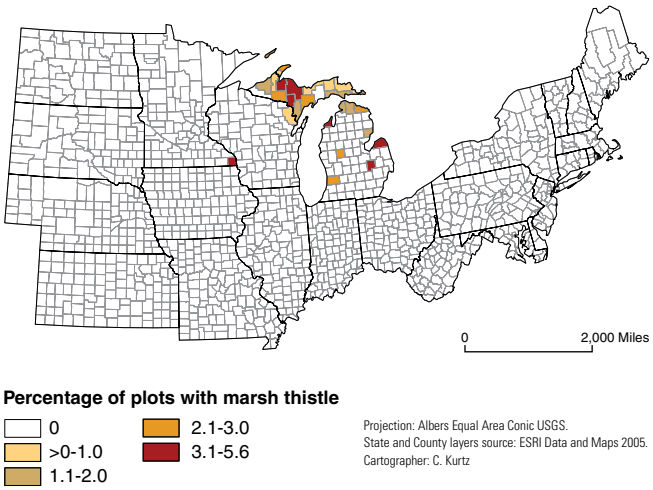

Figure 64.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2005-2006) and P3 plots (2005-2010) where marsh thistle was observed, by county.

Morrow's honeysuckle

(Lonicera morrowii)

LOMO2

Background and characteristics: Morrow's honeysuckle, a woody shrub of the honeysuckle family (Caprifoliaceae), was introduced in 1875 from Japan for ornamental use and wildlife (Gould and Stuckey 1992, Rathfon 2006). Because of horticultural interest in this species as a hedge with attractive flowers and fruit (Fig. 65), it is commonly found near cities. The presence of Morrow's honeysuckle is also high in disturbed areas due to its affinity for sun, although it will tolerate some shade at the expense of growth (Rathfon 2006).

The establishment of Morrow's honeysuckle is problematic since it leafs out early and reduces nutrient and moisture availability for other plants. It often forms dense thickets that shade out competing understory. Spread occurs by animals, which are a major source of seed dispersal. The fruit is troublesome because the pigments cause color variants in cedar waxwing (*Bombycilla cedrorum*) feathers, creating orange tail bands (Witmer 1996). The effect of the fruit's pigment may impact waxwing breeding success since plumage affects social behavior and mate selection. An additional problem with Morrow's honeysuckle is its ability to hybridize with Tatarian honeysuckle (*Lonicera tatarica*), resulting in the hybrid showy fly honeysuckle, also known as Bell's honeysuckle (*Lonicera xbella*).

Current distribution: Morrow's honeysuckle is found in 28 states with 4 in the Northeast (Connecticut, Massachusetts, New Hampshire, and Vermont) classifying it as banned, prohibited, or noxious. This IPS has also been recorded in New Brunswick, Ontario, Quebec, and Saskatchewan (USDA, NRCS 2012).

P2 and P3 monitoring: Morrow's honeysuckle was monitored on NRS FIA P2 invasive plots from 2007 through 2010 and on P3 plots from 2005 through 2006. It was the fifth most commonly observed IPS, occurring on 271 of 7,107 plots (3.8 percent; Table 2). Abundance was highest in the Northeast with New York having the greatest percentage of forested plots with Morrow's honeysuckle present (21.4 percent). It also ranked among the five most commonly observed IPS in three states (Maine, New York, Pennsylvania) of the NRS FIA region (Table 3). Morrow's honeysuckle was not detected in seven states: Delaware, Indiana, Kansas, Nebraska, New Hampshire, North Dakota, and South Dakota (Fig. 66).

Figure 65.—Morrow's honeysuckle with fruit. Photo by Stacey Leicht, University of Connecticut, Bugwood.org.

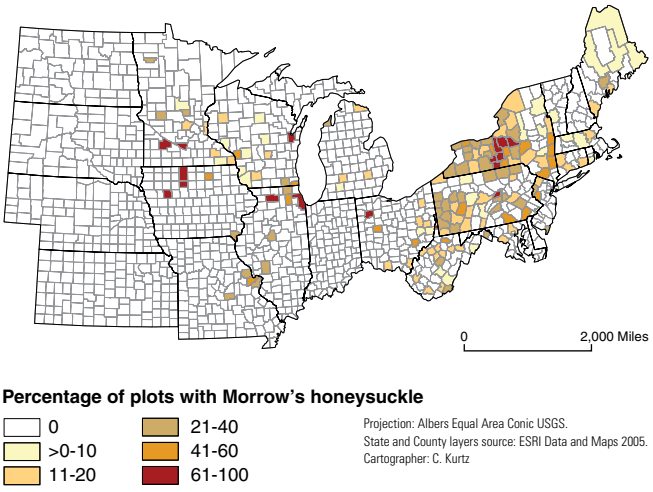

Figure 66.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2007-2010) and P3 plots (2005-2006) where Morrow's honeysuckle was observed, by county.

Multiflora rose

(Rosa multiflora)

ROMU

Background and characteristics: Multiflora rose, a woody shrub of the rose family (Rosaceae), was introduced to the eastern United States in 1866 from Japan as a rootstock for ornamental roses (Gould and Stuckey 1992, Kaufman and Kaufman 2007). This shrub's ability to survive in harsh environments is critical to its success as an invader. Multiflora rose is most commonly found near forest edges with the highest presence within 160.0 feet of an edge (Kurtz 2010). The species exhibits optimal growth in full sun, but high propagule pressure can result in establishment within the forest interior, although the resulting germinants lack vigor and flower production (Kaufman and Kaufman 2007). Growth is also reduced by low and high water tables (Kurtz 2010).

The use of multiflora rose by many agencies including conservation groups, highway departments, and state and local governments for living fences, erosion control, and food and cover for wildlife (Gould and Stuckey 1992, Kaufman and Kaufman 2007, Moser et al. 2009) has increased dispersal. Deer (*Odocoileus* spp.) may contribute to its spread since they may preferentially browse other plant species, creating soil disturbances which facilitate germination (Rawinski 2008). The spread of multiflora rose is aided by the proliferation of flowers which can annually yield one million seeds that are viable up to 20 years (Brakke 2006, Kaufman and Kaufman 2007), making restoration problematic since clearing a site can result in regeneration for many years. Since multiflora rose is able to root where the canes contact the soil, these shrubs can create large, impenetrable masses (Fig. 67) with sharp thorns along the canes that can gash the eyes and skin of domestic animals, cattle, and humans. This shrub's dense growth substantially reduces sun, nutrient, and moisture availability.

In the NRS region, the presence of multiflora rose appears to be climatically restricted. Moser et al. (2009) noted the absence of multiflora rose above 44.0° N latitude, indicative of its northern limit of cold tolerance (-28.0 °F; Czarapata 2005). While this species has been recorded in Canada, the sites may have unique microclimates such as urban heat islands or near buildings. The growth of multiflora rose is also restricted in the southern United States since the seeds require 30 days of cold stratification (Kazaz et al. 2010). However, it can be grown from cuttings.

Current distribution: In the Midwest, Kurtz (2010) found multiflora rose on over half of the FIA plots in Indiana (59.7 percent), Iowa (59.4 percent), and Illinois (52.1 percent). It is now found in five Canadian provinces (British Columbia, New Brunswick, Nova Scotia, Ontario, and Quebec) and 39 states, with many states classifying it as a noxious weed (USDA, NRCS 2012).

Figure 67.—Multiflora rose. Photo by James H. Miller, USDA Forest Service, Bugwood.org.

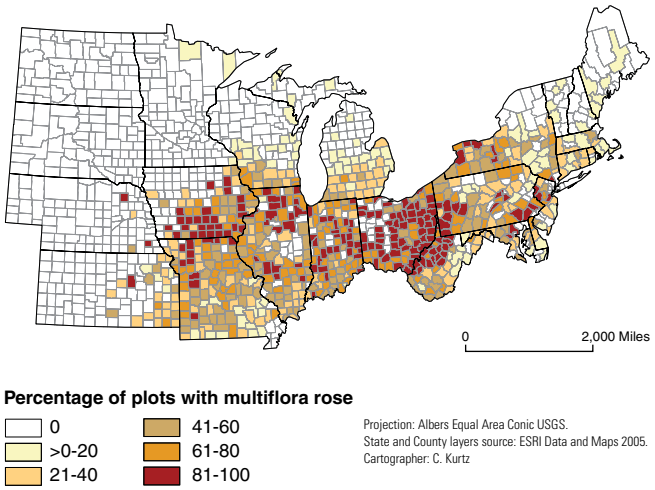

Figure 68.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2005-2010) and P3 plots (2005-2006) where multiflora rose was observed, by county.

P2 invasive and P3 monitoring: Multiflora rose was monitored on NRS FIA P2 invasive plots from 2005 through 2010 and on P3 plots from 2005 through 2006. It was the most commonly observed IPS, occurring on 3,136 of the 18,929 plots (16.6 percent; Table 2). This woody shrub was found on over half of the plots inventoried in Ohio (85.3 percent), Indiana (65.2 percent), Iowa (59.0 percent), West Virginia (54.7 percent), and Illinois (54.3 percent). Multiflora rose ranked among the five most frequently recorded IPS monitored in 19 of the 24 states and was the most common invasive in 10 states (Table 3). This invader was not detected in only two states of the NRS FIA region, North and South Dakota (Fig. 68).

Nepalese browntop

(Microstegium vimineum)
MIVI

Background and characteristics: Nepalese browntop, also known as Japanese stiltgrass, is a member of the grass (Poaceae) family commonly known as packing grass. It is native to southeastern Asia and was introduced to Tennessee in 1919 from Oriental porcelain packing material that contained seeds (Barden 1987, Kaufman and Kaufman 2007). The success of Nepalese browntop can partly be attributed to its ability to grow in sun or shade (Fig. 69). The seeds of this IPS are viable 3 to 5 years, and each plant can yield up to 1,000 seeds annually (Czarapata 2005). It prefers to grow in acidic to neutral, highly organic soils in floodplain forests and stream banks, however it can grow in forests, fields, and slightly alkaline soils (Kaufman and Kaufman 2007). Where Nepalese browntop establishes, it can change the nutrient cycle as the decaying plants increase soil organic matter and pH (Kaufman and Kaufman 2007).

Facilitating the spread of Nepalese browntop is its ability to root where the nodes contact the soil. Deer may also promote this species since they do not browse it and instead browse other species, creating soil disturbances that facilitate germination (Kaufman and Kaufman 2007, Rawinski 2008). This has been seen in an eastern hemlock forest where deer promoted invasion by Nepalese browntop (Booth et al. 2010). Colonization occurs rapidly on disturbed sites with slower invasion on sites that have not been disturbed (Barden 1987). Within 5 years this aggressive invader can take over a plant community (Kaufman and Kaufman 2007).

Current distribution: Nepalese browntop is now found in Puerto Rico and 24 states, primarily in the southeastern part of North America. Alabama lists this aggressive invader as a Class C noxious weed, Connecticut as invasive and banned, and Massachusetts as prohibited; there are no documented occurrences in Canada (USDA, NRCS 2012).

P2 and P3 monitoring: Nepalese browntop was monitored on NRS FIA P2 invasive plots from 2005 through 2010 and on P3 plots from 2005 through 2006. This graminoid was the 14th most commonly observed IPS, occurring on 400 of the 18,929 plots (2.1 percent; Table 2). It ranked among the five most commonly observed IPS (Table 3) in six states: Delaware, Indiana, Maryland, New Jersey, Pennsylvania, and West Virginia. West Virginia and Maryland had Nepalese browntop on over a quarter of the forested inventory plots (32.0 and 25.3 percent, respectively). As a percentage of the total number of monitored plots, the southeastern part of this region had the most plots with this species (Fig. 70). Eleven states in the NRS FIA region did not have Nepalese browntop present.

Figure 69.—Nepalese browntop infestation. Photo by Chris Evans, River to River CWMA, Bugwood.org.

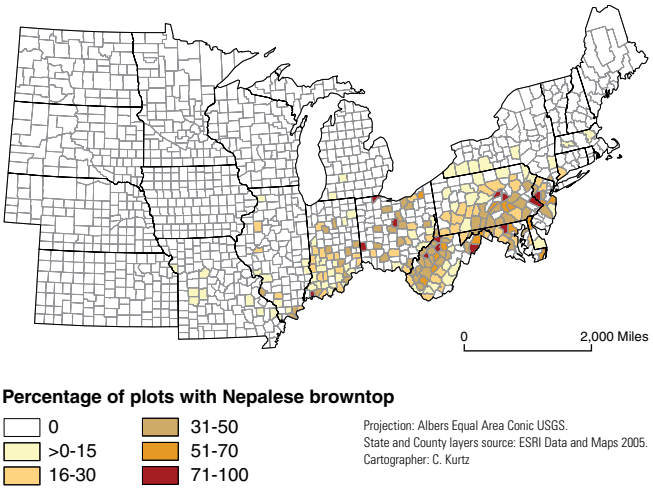

Figure 70.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2005-2010) and P3 plots (2005-2006) where Nepalese browntop was observed, by county.

Nonnative bush honeysuckles

(Lonicera* spp.*)
LONIC

Backgound and characteristics: The nonnative bush honeysuckle species that are present in this region were imported from Eurasia for ornamental use. They produce an abundance of flowers (Fig. 71) and fruit that animals, including the wild turkey (Meleagris gallopavo), commonly disperse. Nonnative bush honeysuckles were planted to assist with turkey recovery, which in turn spread the plants through seed dispersal (Zouhar et al. 2008). Humans have also played a large role in the distribution of these shrubs since they are commonly used as ornamental shrubs, and federal agencies promoted planting them. Kurtz (2010) found the presence of this genus greatest near cities and forest edges, reflecting anthropogenic influence and their affinity for full sun.

Nonnative bush honeysuckles have several traits that contribute to their success as invaders. They leaf out before many native plants and hold their leaves later in the season, giving them a competitive advantage by having a longer time to photosynthesize. Once established, the plants form dense layers that reduce moisture and nutrient availability and shade out neighboring species.

Current distribution: Nonnative bush honeysuckles are found in all 50 states and 10 provinces (USDA, NRCS 2012).

P2 and P3 monitoring: Nonnative bush honeysuckles were monitored on NRS FIA P2 invasive plots at the genus level from 2005 through 2006 and occurred on 767 of 11,822 plots (6.5 percent; Table 2). Since this genus was not monitored at the species level on P2 invasive plots in 2005-2006, it was not included in the ranking of the other IPS in this report. The genus level analysis of nonnative bush honeysuckles was restricted to the Midwest (Fig. 72) with the highest percentage of plots containing nonnative bush honeysuckles in Illinois (32.7 percent), followed by Indiana (19.9 percent). Iowa and Wisconsin also had greater than 10.0 percent of the plots with nonnative bush honeysuckles present (18.1 and 11.2 percent, respectively).

Figure 71.—Nonnative bush honeysuckle in flower. Photo by Cassandra Kurtz, U.S. Forest Service.

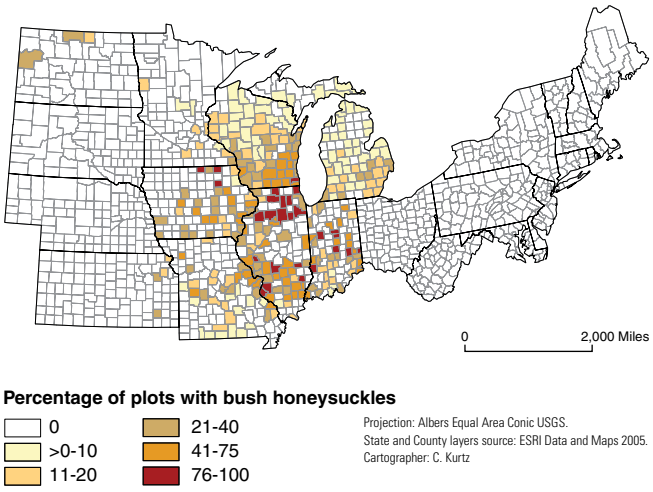

Figure 72.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2005-2006) where nonnative bush honeysuckles was observed, by county.

Norway maple

(Acer platanoides)
ACPL

Background and characteristics: Norway maple, a shade tolerant tree of the maple family (Aceraceae), is native to southern Scandinavia and northern Iran and was introduced as an ornamental to Philadelphia in 1776 (Kaufman and Kaufman 2007). The popularity of Norway maple has lead to the release of many cultivars. Nurseries sell this IPS as an urban shade tree because of its dense canopy, rapid growth, tolerance of air pollution and poor soils, and as a replacement for trees with Dutch elm disease (Kaufman and Kaufman 2007). Its dense canopy and shallow roots make it susceptible to blow-down and difficult for other species to establish beneath it. However, due to Norway maple's shade tolerance, it often forms dense layers on the forest floor (Fig. 73). In areas where this tree becomes established, its allelopathic effects dramatically reduce plant diversity (Gould and Stuckey 1992, Kaufman and Kaufman 2007). Despite the ecological impact of this species, research indicates Norway maple ranks among the most frequently planted street tree species (Kielbaso 1990, Nowak and Rowntree 1990).

According to the Plants Database (USDA, NRCS 2012), it is suggested this noxious tree can survive to -28.0 °F and requires cold stratification, 32.0 to 50.0 inches of precipitation annually, 130 or more frost free days, pH levels between 4.8 and 7.2, and a minimum rooting depth of 40.0 inches. Additional growth limitations are its lack of tolerance of anaerobic conditions, fine and coarse textured soils, fire, and drought.

Current distribution: Norway maple is found in 26 states, with Connecticut listing it as invasive and Massachusetts as prohibited. It has also been recorded in six Canadian provinces: British Columbia, New Brunswick, Nova Scotia, Ontario, Prince Edward Island, and Quebec (USDA, NRCS 2012).

P2 and P3 monitoring: Norway maple was monitored on NRS FIA P2 invasive plots from 2007 through 2010 and on P3 plots from 2005 through 2006. It was the 22nd most commonly observed IPS, occurring on 48 of 7,107 plots (0.7 percent; Table 2). Norway maple was observed in 13 states of the NRS FIA region (Fig. 74) with most observances occurring in the East. The highest constancy (9.0 percent) was in Connecticut.

Figure 73.—Understory invasion by Norway maple. Photo by Cassandra Kurtz, U.S. Forest Service.

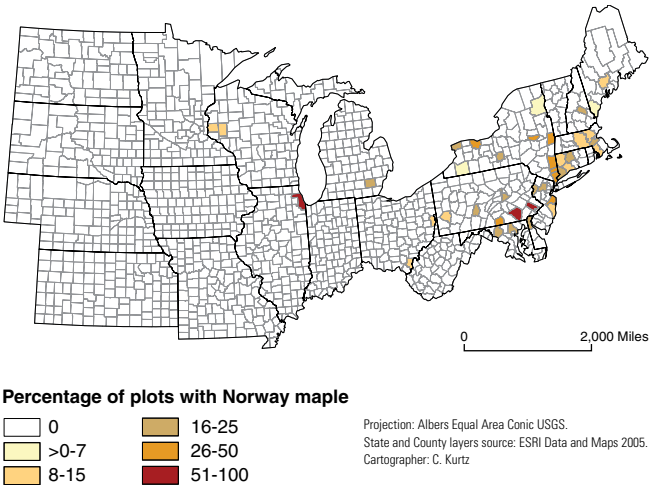

Figure 74.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2007-2010) and P3 plots (2005-2006) where Norway maple was observed, by county.

Oriental bittersweet

(Celastrus orbiculatus)
CEOR7

Background and characteristics: Oriental bittersweet, also known as Asian bittersweet, is a woody vine of the bittersweet or staff vine family (Celastraceae) that is native to temperate Japan, China, and Korea. It was introduced from China as an ornamental vine around 1860 (Kaufman and Kaufman 2007, Leicht and Silander 2006). Its aggressive growth and picturesque fruits (Fig. 75), treasured by crafters, have contributed to the planting and spread of this species. This noxious vine has also been planted throughout the NRS region to promote the recovery of native wild turkey (*Meleagris gallopavo*), which in turn act as dispersal vectors for the seeds (Zouhar et al. 2008). Other avian species disperse the fruit as well which facilitates establishment in forest interiors (Kaufman and Kaufman 2007).

Another vector of this species is gardeners who have planted Oriental bittersweet for its qualities as a landscape plant or inadvertently planted this IPS because of its close resemblance to native American bittersweet (*Celastrum scandens*) which has pointed leaves. Problematically, Oriental bittersweet hybridizes with the somewhat rare American bittersweet, posing a genetic threat (Czarapata 2005, Kaufman and Kaufman 2007, Leicht and Silander 2006).

Oriental bittersweet grows optimally in full sun but is able to live in dense shade, waiting for release to expedite growth and spread (Zouhar et al. 2008). Within the forest this invasive can impede photosynthesis, add excess weight to trees which promotes breakage, and even girdle trees. The aggressive growth of this vine has worrisome fire implications as it can increase the fuel load and likelihood of a crown fire by increasing fuel continuity through growing up and over forest vegetation (Zouhar et al. 2008).

According to the Plants Database (USDA, NRCS 2012), it is suggested this invader can survive to -38.0 °F and requires cold stratification, 30.0 to 60.0 inches of precipitation annually, 100 or more frost free days, pH levels between 5.0 and 7.5, and a minimum rooting depth of 18.0 inches. An additional growth limitation is its intolerance of anaerobic conditions.

Current distribution: The aggressive nature of this IPS is recognized throughout the northeastern United States where it is considered one of the most threatening lianas (Leicht and Silander 2006). Oriental bittersweet is currently found in three Canadian provinces (New Brunswick, Ontario, and Quebec) and 25 states, with 5 states (Connecticut, Massachusetts, New Hampshire, North Carolina, and Vermont) listing it as banned, prohibited, or noxious (USDA, NRCS 2012).

Figure 75.—Oriental bittersweet with fruit. Photo by Leslie J. Mehrhoff, University of Connecticut, Bugwood.org.

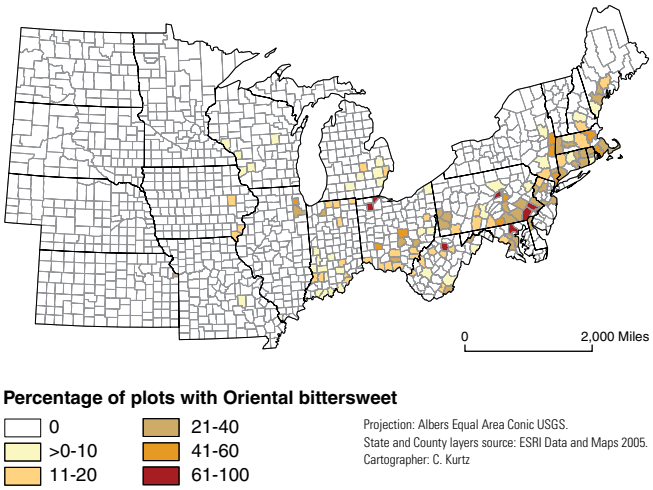

Figure 76.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2005-2010) and P3 plots (2005-2006) where Oriental bittersweet was observed, by county.

P2 and P3 monitoring: Oriental bittersweet was monitored on NRS FIA P2 invasive plots from 2005 through 2010 and on P3 plots from 2005 through 2006. It was the 20th most commonly observed IPS, occurring on 194 of 18,929 plots (1.0 percent; Table 2). In this region, Rhode Island had this species present on 24.2 percent of the plots while Massachusetts and Connecticut followed closely with 18.9 and 17.9 percent of the plots having Oriental bittersweet present (respectively). Five states in the NRS FIA region (Minnesota, Nebraska, North Dakota, South Dakota, and Vermont) did not have this invasive vine present (Fig. 76).

Princesstree

(Paulownia tomentosa)
PAT02

Background and characteristics: Princesstree, a member of the figwort family (Scrophulariaceae), is a fast-growing tree native to China that was introduced to the United States in 1843 (Foster and Duke 2000). This IPS grows in full sun to part shade and is planted in urban areas for its aesthetic beauty (Fig. 77). Princesstree is also planted in the United States for its valuable wood. The wood is desired for many uses such as making wardrobe furniture, cabinets, small chests, packing crates, musical instruments, bowls, and footwear (Melhuish et al. 1990). The desirability of the wood has resulted in planting this tree in some areas for agroforestry because of the high export price, especially to Japan where the wood is greatly valued (Foster and Duke 2000). Due to the widespread planting of this tree, it has begun to escape into nearby areas and displace native species.

Aside from the timber value, this tree serves many medicinal purposes (Foster and Duke 2000). The Chinese have traditionally used the leaves and capsules to promote hair growth and prevent graying, a leaf tea for swollen feet, the inner bark for fevers and delirium, the leaves and bark as a dressing for bruises, and the flowers (mixed with other herbs) as a treatment for liver ailments. In addition, the Japanese have reported the leaf juice to be valuable for treating warts.

The USDA PLANTS Database (USDA, NRCS 2012) suggests this noxious tree can survive to -8.0 °F and requires 30.0 to 55.0 inches of precipitation annually, 180 or more frost free days, pH levels between 4.5 and 7.5, and a minimum rooting depth of 36.0 inches. Additional growth limitations are its intolerance of anaerobic, calcareous, and fine textured soils.

Current distribution: Princesstree is found primarily in the eastern half of the United States, occurring in 26 states (USDA, NRCS 2012). In Connecticut, this IPS is considered potentially invasive and has banned selling it (USDA, NRCS 2012).

Figure 77.—Princesstree in flower. Photo by James R. Allison, Georgia Department of Natural Resources, Bugwood.org.

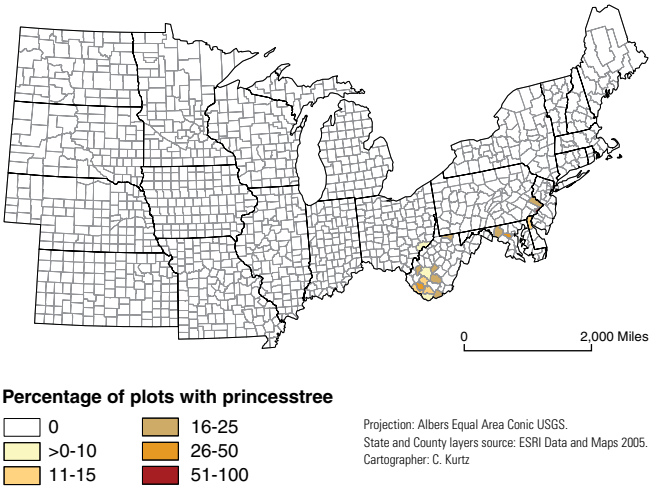

Figure 78.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2007-2010) and P3 plots (2005-2006) where princesstree was observed, by county.

P2 and P3 monitoring: Princesstree was monitored on NRS FIA P2 invasive plots from 2007 through 2010 and on P3 plots from 2005 through 2006. It was the 29th most commonly observed IPS, occurring on 20 of 7,107 plots (0.3 percent; Table 2). This invasive tree was found in five states (Fig. 78) of the NRS FIA region (Delaware, Maryland, Ohio, Pennsylvania, and West Virginia) with West Virginia having the highest percentage of plots (4.2 percent) containing this species.

Punktree

(Melaleuca quinquenervia)
MEQU

Background and characteristics: Punktree, also known as melaleuca, paperbark tree, and cajeput tree, is a highly flammable tree of the myrtle family (Myrtaceae) that can reach up to 80.0 feet (Kaufman and Kaufman 2007). It was introduced to soak up water from the Everglades during the early 1900s (Gould and Stuckey 1992, Kaufman and Kaufman 2007). There has also been interest in this tree as an ornamental due to its unique, flakey bark. Due to its prolific spread, it is listed as the exotic weed of greatest risk to southern Florida wetlands (Turner et al. 1998).

An aggressive species, this invader forms dense stands (Fig. 79), reducing species diversity 60.0 to 80.0 percent (Gould and Stuckey 1992, Turner et al. 1998). Not only do the dense stands alter the native plant community, they also affect the animals which depend on the displaced plant. It is estimated that an average of 12 species of animals rely on each plant species outside of the tropics (Gould and Stuckey 1992).

Aside from the impact punktree has on the forest community, this plant may also pose health risks. It is suggested the pollen of punktree is a mild respiratory allergen (Turner et al. 1998). Because of the ecological, health, and economic impacts caused by this species, its presence is a concern.

Current distribution: Punktree is found in Florida, Hawaii, Louisiana, and Puerto Rico with nine states listing it as noxious, quarantine, prohibited, or an invasive aquatic plant (USDA, NRCS 2012). Punktree is also listed on the Federal noxious weed list (USDA, NRCS 2012).

P2 and P3 monitoring: FIA monitored NRS FIA P2 invasive plots from 2007 through 2010 and P3 plots from 2005 through 2006 for the presence of punktree. However, it was not observed on any of the 7,107 plots during this timeframe.

Figure 79.—Invasion by punktree. Photo by Amy Ferriter, State of Idaho, Bugwood.org.

Purple loosestrife

(Lythrum salicaria)
LYSA2

Background and characteristics: Purple loosestrife is an herbaceous perennial of the loosestrife family (Lythraceae). This noxious weed is native to Europe and Asia, and one of the first reports of its presence was in 1814 along the Northeast coast where it is now heavily concentrated (Kaufman and Kaufman 2007). Planting of this IPS occurred for medicinal and ornamental reasons (Fig. 80) as well as for the production of honey.

Purple loosestrife covers 1/2 million acres in the U.S. due to its ability to survive in a variety of moisture classes, high seed production (up to 2 million seeds), lack of natural predators, and ability to grow from plant fragments (Czarapata, 2005, Kaufman and Kaufman 2007). Additional traits that help promote the spread of this species include seeds that remain viable for 20 years and that can live submerged in water for 20 months (Czarapata 2005). Problematically, the rootstock is able to send up 30 to 50 stems and form masses up to 8.0 feet high and 5.0 feet wide (Kaufman and Kaufman 2007).

Purple loosestrife grows optimally in full sun and vigor diminishes in low light levels. Where it invades, monocultures can become so dense that they can crowd out fish and waterfowl from wetlands by growing up to 80,000 stalks per acre (Czarapata 2005). Its aggressive growth and displacement of natives has pushed many species of rare amphibians and butterflies to the brink of extinction (Czarapata 2005). Purple loosestrife is also problematic in agricultural areas. This herbaceous invader can devastate cucumber (*Cucumis sativus*) crops since it is an alternate host for cucumber mosaic virus (Royer and Dickinson 1999).

The presence of purple loosestrife is a concern. Its negative effects are so great that it ranks among The Nature Conservancy's "Dirty Dozen" alien species (Nature Conservancy 1996), which is a composite list of 12 intrusive invasive plants and animals. Due to the implications caused by this species, researchers have monitored its spread over time, noticing that it spread first along canals and waterways and then along roadways (Booth et al. 2010). From 1940 to 1980 purple loosestrife spread at a rate of approximately 1.5 latitude-longitude blocks per year (Westbrooks 1998).

Aside from the negative impacts caused by purple loosestrife, medicinal properties have been found. It has traditionally been used for diarrhea, dysentery, sore throats, leukorrhea, cleansing wounds, and experimentally to stop bleeding, for inflammation, and to kill bacteria (Foster and Duke 2000).

Figure 80.—Ornamental planting of purple loosestrife. Photo by Steve Dewey, Utah State University, Bugwood.org.

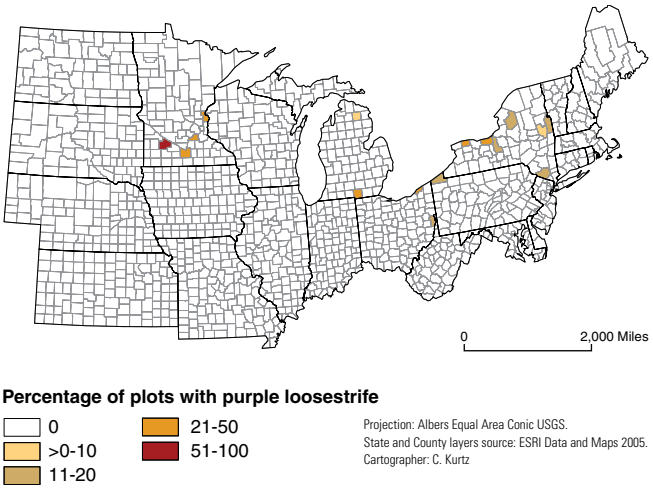

Figure 81.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2007-2010) and P3 plots (2005-2006) where purple loosestrife was observed, by county.

Current distribution: Purple loosestrife has spread to all of the lower 48 states except Florida (Kaufman and Kaufman 2007). The widespread planting of purple loosestrife has resulted in 33 states creating various classifications and restrictions to discourage the spread of this IPS (USDA, NRCS 2012). With climate change, purple loosestrife may become an increasingly troublesome weed because of its ability to take advantage of favorable environmental conditions when they occur earlier than expected (Booth et al. 2010).

P2 and P3 monitoring: Purple loosestrife was monitored on NRS FIA P2 invasive plots from 2007 through 2010 and on P3 plots from 2005 through 2006. It was the 30th most commonly observed IPS, occurring on 17 of 7,107 plots (0.2 percent; Table 2). Purple loosestrife was observed in five states: Michigan, Minnesota, New York, Ohio, and Pennsylvania (Fig. 81).

Reed canarygrass

(Phalaris arundinacea)
PHAR3

Background and characteristics: Reed canarygrass, a member of the grass family (Poaceae), begins growing very early in the spring and has been bred to withstand a variety of environmental conditions. In the 1830s, New England agronomists began developing strains adaptable to a wider range of conditions (Kaufman and Kaufman 2007). Adaptation to a variety of conditions coupled with aggressive growth, has resulted in the frequent use of this IPS in restoration and agriculture. Many strains of reed canarygrass are widely available for forage, restoration, and ornamental use. It is also used for soil contaminant extraction (Kaufman and Kaufman 2007, Lavergne and Molofsky 2004). Ribbon grass (*P. arundinacea* var. *picta*), a variety of reed canarygrass also known as gardener's garters, is grown for its white variegated leaves and is readily available as a landscape plant. Where reed canarygrass establishes, it often forms dense monocultures, excluding the growth of other plant species (Fig. 82).

This species is found throughout the NRS region as both a native and a nonnative species. Differentiation between the native and nonnative species is very difficult. Establishment is generally in the sun though it can occur in shaded areas such as along restored logging roads and roadways. In Europe, reed canarygrass is most common from 35.0° to 44.0° N latitude which is consistent with its distribution in the American Midwest (Kurtz 2010). It is predicted that climate change will reduce coverage from 35.0° to 44.0° N latitude and increase coverage from 45.0° to 71.0° N latitude (Kurtz 2010). Lavergne and Molofsky (2004) also suggest climate change may impact the distribution of reed canarygrass since growth is typically optimal under cool, moist conditions.

According to the Plants Database (USDA, NRCS 2012), it is suggested this noxious graminoid can survive to -38.0 °F and requires 30.0 to 65.0 inches of precipitation annually, 120 or more frost free days, pH levels between 5.5 and 8.0, and a minimum rooting depth of 14.0 inches. Additional limits to its presence are its moderate tolerance of saline and calcareous soils, and intolerance of coarse soils.

Current distribution: Widespread invasions by both the native and nonnative strains occur throughout the region monitored by the NRS. The success of reed canarygrass as an invader is evident since it is found throughout the world, with the exception of Antarctica and Greenland (Smith 1997). Within the United States, it is found in 43 states and is classified as invasive in Connecticut, prohibited in Massachusetts, and noxious in Washington; it is also found in 10 Canadian provinces (not present in Labrador), two territories (Northwest and Yukon Territories), Saint Pierre, and Miquelon (USDA, NRCS 2012).

Figure 82.—Reed canarygrass infestation. Photo by Jamie Nielsen, University of Alaska Fairbanks, Cooperative Extension Service, Bugwood.org.

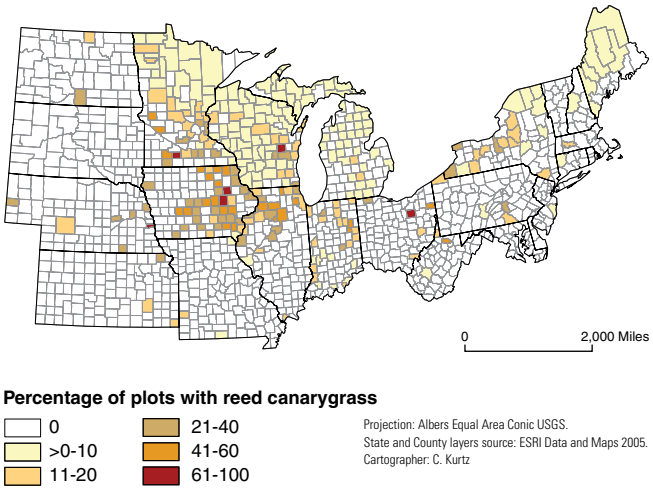

Figure 83.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2005-2010) and P3 plots (2005-2006) where reed canarygrass was observed, by county.

P2 iand P3 monitoring: Reed canarygrass was monitored on NRS FIA P2 invasive plots from 2005 through 2010 and on P3 plots from 2005 through 2006. It was the seventh most commonly observed IPS, occurring on 642 of the 18,929 plots (3.4 percent; Table 2). The highest percentage of plots (21.9 percent) with this species was in Iowa. As can be seen in Figure 83, most of the observances were in the upper Midwest region. Reed canarygrass was not detected on FIA plots in five states: Delaware, Maryland, Rhode Island, South Dakota, and Vermont.

Russian olive

(Elaeagnus angustifolia)

ELAN

Background and characteristics: Russian olive, a tree in the olive family (Elaeagnaceae), was introduced to the United States in the late 1800s as an ornamental plant from southeastern Europe and Asia (Kaufman and Kaufman 2007, Stannard et al. 2002). As an ornamental, its silvery foliage is often used as accent against neighboring trees. Other common uses of this tree are for wildlife, windbreaks, and shelterbelts. Optimal growth of Russian olive occurs in full sun, though it is able to grow in the shade. This species is of concern since it negatively impacts forage, vegetation, and water availability (Carman and Brotherson 1982).

There is great concern over the presence of Russian olive in riparian areas (Fig. 84), especially in the West where it can tolerate the poor soils and wet, saline conditions. In these areas, this invasive tree draws large quantities of water from the water table in comparison to native species (Carman and Brotherson 1982). This IPS also impacts the native species by changing the composition of the plant community through fixing nitrogen and altering the nutrient cycle (Kaufman and Kaufman 2007). Russian olive not only affects the vegetation, it also impacts avian species through degraded site quality from the loss of native plants, nesting sites, and insects (Stannard et al. 2002).

Through discriminant analysis, Carman and Brotherson (1982) suggested Russian olive was found on soils with low to medium (100 to 3,500 parts per million) soluble salt levels. Based on the literature and field observations, it is suggested this noxious tree can survive to -38.0 °F and requires cold stratification, 12.0 to 40.0 inches of precipitation annually, 100 or more frost free days, pH levels between 6.0 and 9.5, and a minimum rooting depth of 16.0 inches. Russian olive is able to grow in calcareous soil but is limited by anaerobic conditions and fine textured soils (USDA, NRCS 2012).

Current distribution: Russian olive is found in 37 states with no occurrences recorded in 7 states of the Southeast (USDA, NRCS 2012). Colorado and New Mexico list Russian olive as a noxious weed, and Connecticut lists it as potentially invasive and banned. It is also found in eight Canadian provinces but is not present in Prince Edward Island, Labrador, and Newfoundland (USDA, NRCS 2012).

Figure 84.—Invasion by Russian olive. Photo by Steve Dewey, Utah State University, Bugwood.org.

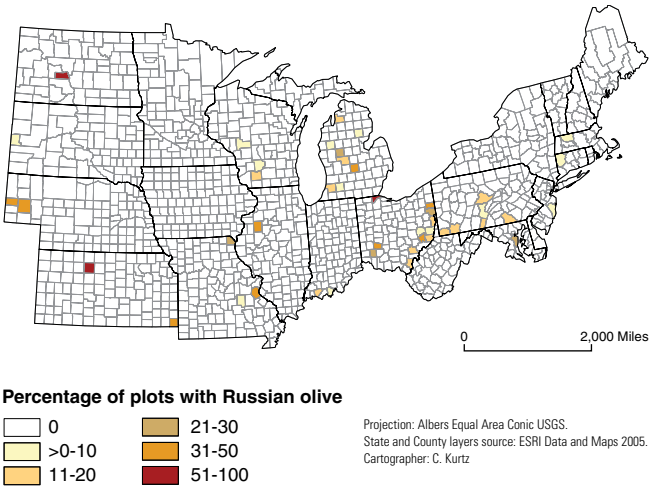

Figure 85.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2007-2010) and P3 plots (2005-2006) where Russian olive was observed, by county.

P2 and P3 monitoring: Russian olive was monitored on NRS FIA P2 invasive plots from 2007 through 2010 and on P3 plots from 2005 through 2006. It was the 23rd most commonly observed IPS, occurring on 46 of 7,107 plots (0.6 percent; Table 2). Russian olive was observed in 15 States of the NRS FIA region (Fig. 85), occurring on 5 percent or less of the plots in all states.

Saltcedar

(Tamarix ramosissima)
TARA

Background and characteristics: Saltcedar is a phreatophyte of the tamarix family (Tamaricaceae). Several species were introduced in the 1820s, and taxonomists disagree on which ones are present (Kaufman and Kaufman 2007). The first escapees were found in the 1870s and by the 1920s it became evident that some species of saltcedar were becoming a serious problem (Di Tomaso 1998). Current estimates of the area invaded by this species could not be found, but previous estimates were at greater than 1 million acres (Di Tomaso 1998, Kaufman and Kaufman 2007).

Saltcedar is a great concern in the western part of the United States because of its hydrologic implications. Introduced as an ornamental with showy foliage and flowers (Fig. 86), saltcedar has spread into natural areas. It is particularly troublesome in the arid Southwest where this species is taking over habitat along rivers and streams and changing the water flow. This IPS dried up Bylas Springs in Arizona's Apache Indian Reservation which caused insects and birds to disappear and destroyed habitat of the endangered desert pupfish (*Cyprinodon macularius*) (Westbrooks 1998).

Saltcedar is a worrisome invasive species because of its seed production (1/2 million seeds annually; Nature Conservancy 1996), cold (Martine et al. 2008) and drought tolerance, high water use (due to evapotranspiration), ability to increase soil salinity from salt accumulation in its leaves, be submerged for over 2 months, and rapid growth (up to 12.0 feet annually; Di Tomaso 1998, Kaufman and Kaufman 2007). The height of this tree varies by species.

The high evapotranspiration rate of saltcedar puts other species at risk through lowering the water table level and reducing the moisture available. McCormick et al. (2010) suggest that saltcedar consumes 10 to 20 times as much water as native species, which may greatly impact riparian areas. In areas with depleted water and high salinity levels, such as where there has been extensive irrigation, saltcedar is one of a limited number of species that is able to survive. Its negative effects are so great that *Tamarix* spp. rank among The Nature Conservancy's "Dirty Dozen" alien species (Nature Conservancy 1996). Aside from the negative implications caused by this IPS, it is an important species to the endangered Southwestern willow flycatcher (*Empidonax trailii extimus*) which uses this tree for shelter (Kaufman and Kaufman 2007).

Figure 86.—Showy foliage and flowers of saltcedar. Photo by Cassandra Kurtz, U.S. Forest Service.

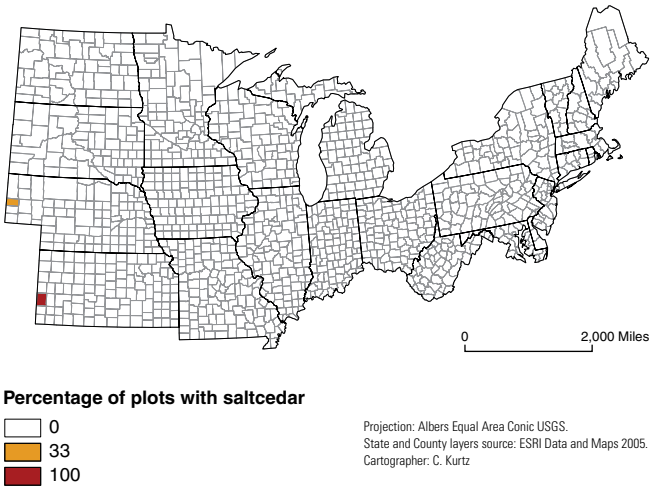

Figure 87.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2007-2010) and P3 plots (2005-2006) where saltcedar was observed, by county.

Current distribution: Saltcedar is found in 19 states, with 11 classifying it as noxious (USDA, NRCS 2012).

P2 and P3 monitoring: Saltcedar was monitored on NRS FIA P2 invasive plots from 2007 through 2010 and on P3 plots from 2005 through 2006. It was tied with Bohemian knotweed and silktree as the 41st most commonly observed IPS. All three species occurred on 2 of 7,107 plots (<0.1 percent; Table 2). Saltcedar was observed on FIA plots in two states of the NRS FIA region, Kansas and Nebraska (Fig. 87). Both observances were on the western side of these states.

Showy fly honeysuckle

(Lonicera xbella)

LOBE

Background and characteristics: Showy fly honeysuckle, also known as Bell's honeysuckle, is a woody shrub of the honeysuckle family (Caprifoliaceae) that occupies an approximate latitudinal range of 35.0° to 54.0° N in North America (Barnes and Cottam 1974). A Eurasian hybrid, it is the result of hybridization between Morrow's and Tatarian honeysuckles, and differentiation between this species and its parents can be difficult. Like its parents, there is horticultural interest in this species as a hedge due to its aesthetically pleasing flowers (Fig. 88) and fruit.

Showy fly honeysuckle has several characteristics of a successful invader. It favors disturbed sites and is tolerant of a wide range of soil moisture and type, temperature, and light (Barnes and Cottam 1974). In addition, the leaves of this shrub emerge early in the growing season and are held later in the season than many native species, a competitive advantage that increases carbon gain and shades out neighboring vegetation.

Current distribution: An aggressive invader, this IPS is now found in 23 states with Connecticut listing it as invasive and banned, Massachusetts and New Hampshire as prohibited, and Vermont as a noxious weed. It is also found in four Canadian provinces: New Brunswick, Ontario, Quebec, and Saskatchewan (USDA, NRCS 2012).

P2 and P3 monitoring: Showy fly honeysuckle was monitored on NRS FIA P2 invasive plots from 2007 through 2010 and on P3 plots from 2005 through 2006. It was the 18th most commonly observed IPS, occurring on 81 of 7,107 plots (1.1 percent; Table 2). Showy fly honeysuckle was observed in 10 states of the NRS FIA region (Fig. 89) with Ohio having the highest constancy (4.8 percent). It was absent from the Plains states and a few states of the Northeast.

Figure 88.—Showy fly honeysuckle in flower. Photo by Joseph Berger, Bugwood.org.

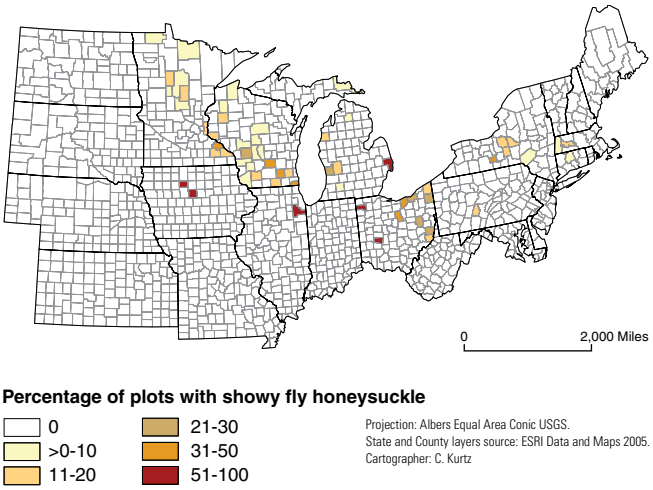

Figure 89.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2007-2010) and P3 plots (2005-2006) where showy fly honeysuckle was observed, by county.

Siberian elm

(Ulmus pumila)
ULPU

Background and characteristics: Siberian elm, a member of the elm family (Ulmaceae), is native to northern China, eastern Siberia, Manchuria, and Korea and was introduced as a tree for windbreaks in the 1860s (Kaufman and Kaufman 2007). In eastern Asia, this IPS is one of the major tree species for timber, shelter, and fodder (Cogolludo-Agustín et al. 2000). Small, wind-dispersed seeds are responsible for its aggressive spread, formation of dense thickets, and displacement of native species. Siberian elm has little shade tolerance and grows optimally in the sun. Its rapid growth, cold and drought tolerance, and resistance to Dutch elm disease have made Siberian elm a desirable tree which is still commercially available. Due to its resistance to Dutch elm disease, this tree is commonly used in breeding programs (Cogolludo-Agustín et al. 2000). However, it is less attractive (Fig. 90) than the American elm (*Ulmus americana*) and is a problematic tree in areas with ice and snowstorms as it tends to break because the wood is weak.

According to the USDA PLANTS Database (USDA, NRCS 2012), it is suggested this noxious tree can survive to -38.0 °F and requires cold stratification, 16.0 to 50.0 inches of precipitation annually, 90 or more frost free days, pH levels between 5.5 and 8.0, and a minimum rooting depth of 24.0 inches. Its rapid growth, to 40.0 feet in 20 years, is restricted by anaerobic conditions and fires.

Current distribution: Widespread planting of Siberian elm has lead to its occurrence in six Canadian provinces (British Columbia, Manitoba, New Brunswick, Ontario, Quebec, and Saskatchewan) and 43 states, along with classification as a Class C noxious weed in New Mexico (USDA, NRCS 2012).

P2 and P3 monitoring: Siberian elm was monitored on NRS FIA P2 invasive plots from 2007 through 2010 and on P3 plots from 2005 through 2006. It was the 25th most commonly observed IPS, occurring on 42 of 7,107 plots (0.6 percent; Table 2). Siberian elm was found in 11 states of the NRS FIA region with the highest percentage of plots with this invasive tree occurring in Nebraska (14.0 percent), where it also ranked as the most frequently observed IPS (Table 3). Siberian elm was not found on plots in the northeastern part of the study area (Fig. 91).

Figure 90.—Siberian elm. Photo by Cassandra Kurtz, U.S. Forest Service.

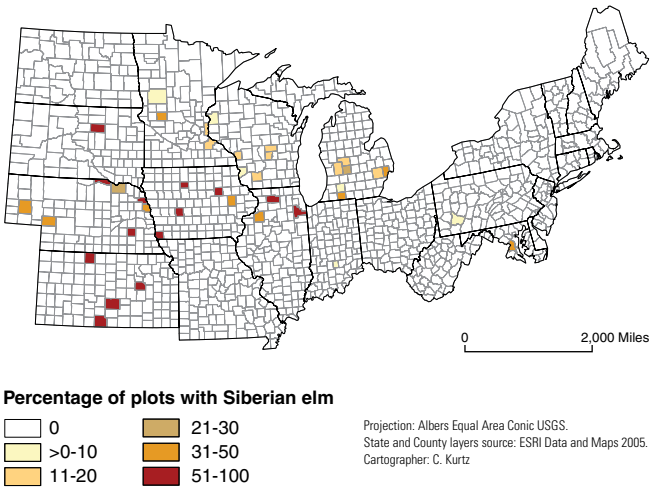

Figure 91.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2007-2010) and P3 plots (2005-2006) where Siberian elm was observed, by county.

Silktree

(Albizia julibrissin)
ALJU

Background and characteristics: Silktree, also known as mimosa or mimosa tree, is a short-lived leguminous tree of the pea family (Fabaceae) that was introduced from Asia to Europe and then to North America in the mid-18th century (Ulyshen and Miller 2007). It is a prized landscape tree, offering aesthetically pleasing fern-like doubly compound leaves and unique, fragrant flowers that have a 'fluffy' appearance (Fig. 92). A short tree, it only grows to about 40.0 feet tall (Kaufman and Kaufman 2007).

Medicinally it is an important species for insomnia caused by anxiety, depression, and restlessness, as well as a poultice for traumatic injuries (Foster and Duke 2000). However, these beneficial traits are strongly outweighed by the negative consequences caused by this invader. As an aggressive spreading tree, silktree can change the forest community by displacing native flora. It can be difficult to restore an invaded site because the trees resprout and produce suckers, and the seeds can remain viable up to 50 years (Kaufman and Kaufman 2007).

The PLANTS Database (USDA, NRCS 2012) suggests silktree can survive to 2.0 °F and requires 30.0 to 60.0 inches of precipitation annually, 200 or more frost free days, pH levels between 4.8 and 7.3, and a minimum rooting depth of 30.0 inches. It is able to grow in floodplains, on a wide variety of soil types, and is drought, wind, and salt tolerant (Kaufman and Kaufman 2007). Other limitations to the growth of silktree include its intolerance of shade and anaerobic conditions.

Current distribution: Silktree is found in 28 states (USDA, NRCS 2012).

P2 and P3 monitoring: Silktree was monitored on NRS FIA P2 invasive plots from 2007 through 2010 and P3 plots from 2005 through 2006. It was tied with Bohemian knotweed and saltcedar as the 41st most commonly observed IPS. Each of these species occurred on 2 of the 7,107 plots (<0.1 percent; Table 2). Silktree was only observed in one NRS FIA state, Missouri (Fig. 93). Both observances were in the southern part of the state.

Figure 92.—Showy flowers of silktree. Photo by Lesley Ingram, Bugwood.org.

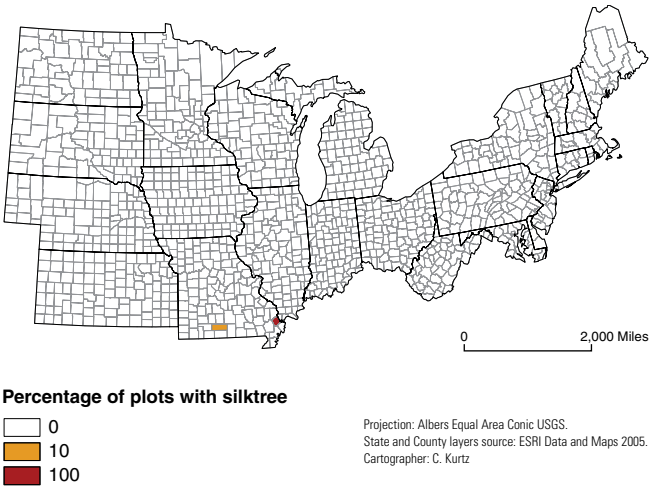

Figure 93.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2007-2010) and P3 plots (2005-2006) where silktree was observed, by county.

Spotted knapweed

(Centaurea stoebe* syn. *C. biebersteinii, C. maculosa)
CEST8

Background and characteristics: Spotted knapweed, a short-lived perennial of the aster family (Asteraceae), is native to Eurasia and was probably introduced in the 1890s via ship ballast water or contaminated hay or alfalfa (*Medicago sativa*) seeds (Czarapata 2005, Kaufman and Kaufman 2007). This IPS thrives in sun or light shade (Fig. 94) and is very drought tolerant. Spotted knapweed is often found in disturbed areas such as along hiking trails and roads as well as in pastures where livestock preferentially graze the other species and facilitate its spread by disturbing the soil. A single plant can produce 1,000 seeds that remain viable from 5 to 8 years (Kaufman and Kaufman 2007).

Another characteristic which contributes to the success of spotted knapweed is its phytotoxicity. Spotted knapweed produces catechin, an allelochemical that is poisonous to other plants and stays in the soil, making restoration difficult and changing the faunal and floral community (Czarapata 2005, Kaufman and Kaufman 2007, Royer and Dickinson 1999). In addition to effects on the floral community, elk (*Cervus elaphus*) in Montana have also suffered from spotted knapweed infestations, causing a 50.0 to 90.0 percent reduction of their winter forage (Czarapata 2005).

Another negative impact of spotted knapweed was found in a study in Montana which showed runoff increased 56.0 percent and sediment yield increased 92.0 percent in areas dominated by spotted knapweed versus native bunchgrass vegetation (Czarapata 2005). Spotted knapweed has caused widespread impacts (Fig. 95) and infested over 8,500 acres of rangeland in British Columbia and hundreds of thousands of acres in the northwestern United States (Royer and Dickinson 1999). Economically the effects caused by spotted knapweed have been substantial. In Montana the cost of infestation is estimated at $14 million annually, with direct and secondary impacts totaling $42 million, enough to support over 500 jobs in the state (Czarapata 2005).

Current distribution: Spotted knapweed is found in six Canadian provinces (Alberta, British Columbia, New Brunswick, Nova Scotia, Ontario, and Quebec), one territory (Yukon), and 46 states (not present in Alaska, Mississippi, Oklahoma, and Texas). Sixteen states classify this aggressive weed as regulated, prohibited, invasive, banned, restricted, quarantine, or noxious (USDA, NRCS 2012).

Figure 94.—Spotted knapweed in flower. Photo by Catherine Herms, The Ohio State University, Bugwood.org.

Figure 95.—Spotted knapweed infestation. Photo by L.L. Berry, Bugwood.org.

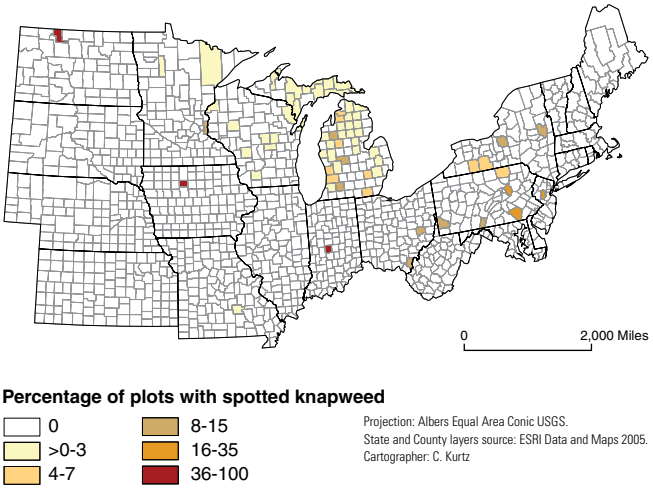

Figure 96.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2005-2010) and P3 plots (2005-2006) where spotted knapweed was observed, by county.

P2 and P3 monitoring: Spotted knapweed was monitored on NRS FIA P2 invasive plots from 2005 through 2010 and on P3 plots from 2005 through 2006. It was the 26th most commonly observed IPS, occurring on 99 of 18,929 plots (0.5 percent; Table 2). Spotted knapweed was present in 11 states (Fig. 96) with each having less than 2.0 percent of the plots with this species.

Tallow tree

(Triadica sebifera)
TRSE6

Background and characteristics: Tallow tree, also known as Chinese tallow tree, popcorn tree, chicken tree, vegetable tallow, and Florida aspen, is a tree of the spurge family (Euphorbiaceae) that can reach up to 60.0 feet. It was introduced for soap and candle making, arriving in Charleston, SC in 1776. The U.S. Department of Agriculture promoted the tallow tree for oil production in the 1920s and 1930s (Kaufman and Kaufman 2007). Its value as an oil resulted in the Chinese and American forces using this species for diesel in World War II, and it is being further investigated as a renewable fuel for use in jet engines (Mason 1997). Tallow tree can annually yield 500.0 gallons of fats and oils per acre.

Despite the fact that tallow tree has value as a renewable fuel, its presence is a concern. This fast-growing IPS is able to survive in sun or shade, produces an abundance of seeds (Fig. 97) which are dispersed by birds and waterways, tolerates high salinity levels, and is allelopathic (Nature Conservancy 1996). The decomposition of its foliage can change the chemistry of soil and water by increasing nitrogen and phosphorus levels (Kaufman and Kaufman 2007). In addition, tallow tree is toxic to animals and humans (Kaufman and Kaufman 2007). Its negative effects are so great that it ranks among The Nature Conservancy's "Dirty Dozen" alien species (Nature Conservancy 1996).

Figure 97.—Tallow tree with fruit. Photo by Chris Evans, River to River CWMA, Bugwood.org.

Current distribution: Tallow tree is found in 10 states with Florida, Louisiana, Mississippi, and Texas listing it as noxious (USDA, NRCS 2012).

P2 and P3 monitoring: FIA monitored NRS FIA P2 invasive plots from 2007 through 2010 and P3 plots from 2005 through 2006 for the presence of this invasive. However, it was not observed on any of the 7,107 plots during this timeframe.

Tatarian honeysuckle

(Lonicera tatarica)

LOTA

Background and characteristics: Tatarian honeysuckle, a member of the honeysuckle family (Caprifoliaceae), was introduced as an ornamental shrub in 1752 (Barnes and Cottam 1974) from Russia (Gould and Stuckey 1992, Rathfon 2006). Tatarian honeysuckle exhibits optimal growth in full sun but can adapt to other light levels (Brakke 2006), even invading the forest interior (Woods 1993). It is commonly used as a hedge, offering beautiful flowers (Fig. 98) and fruit, as well as for wildlife planting. Birds are a common vector of this invasive shrub.

Tatarian honeysuckle is a concern in forested areas because where this shrub establishes it can form a nearly impenetrable layer. The establishment of this shrub reduces mineral, nutrient, and light availability to native species, impacting regeneration and changing future forest dynamics. It also is troublesome in the forest community because it leafs out early. Woods (1993) found leaf expansion of Tatarian honeysuckle begins about 2 weeks before the trees in northwestern Massachusetts and southwestern Vermont forests, light to the forest floor is reduced approximately 60.0 percent, and its leaves are held longer than other woody species.

Even though Tatarian honeysuckle is able to invade a wide variety of habitats, there are limitations to its presence. According to the Plants Database (USDA, NRCS 2012), it is suggested this noxious shrub can survive to -38.0 °F and requires cold stratification, 32.0 to 50.0 inches of precipitation annually, 120 or more frost free days, pH levels between 5.2 and 7.5, and a minimum rooting depth of 16.0 inches. Additional growth limitations are its intolerance of anaerobic and fine textured soils.

Current distribution: Tatarian honeysuckle is now found in 34 states, primarily the northern half of the United States, and is listed as potentially invasive and banned in Connecticut, prohibited in Massachusetts and New Hampshire, and a Class B noxious weed in Vermont; in Canada it is found in seven provinces: Alberta, Manitoba, New Brunswick, Nova Scotia, Ontario, Quebec, and Saskatchewan (USDA, NRCS 2012).

Figure 98.—Tatarian honeysuckle in flower. Photo by Patrick Breen, Oregon State University, Bugwood.org.

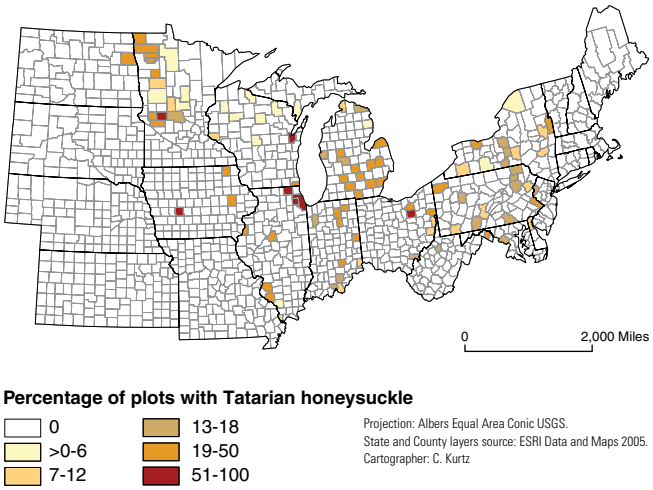

Figure 99.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2007-2010) and P3 plots (2005-2006) where Tatarian honeysuckle was observed, by county.

P2 and P3 monitoring: Tatarian honeysuckle was monitored on NRS FIA P2 invasive plots from 2007 through 2010 and on P3 plots from 2005 through 2006. It was the 16th most commonly observed IPS, occurring on 109 of 7,107 plots (1.5 percent; Table 2). Tatarian honeysuckle was present in 14 states within the NRS FIA region (Fig. 99), and each state had 5 percent or less of the plots containing this species. It was only found on one plot in the Plains states and was absent from several states of the Northeast.

Tree-of-heaven

(Ailanthus altissima)
AIAL

Background and characteristics: Tree-of-heaven, a member of the Quassia family (Simaroubaceae), is native to China and was introduced to the United States in 1748 by a gardener in Philadelphia, PA. In the 1850s, seeds were brought to the West Coast by Chinese immigrants during the Gold Rush. This aggressive tree became known as "tree of heaven" due to its ability to grow out of the rocks on mountains where other trees were unable to grow (Kaufman and Kaufman 2007).

Tree-of-heaven's characteristic rapid growth, aesthetic beauty (Fig. 100), and tolerance of poor sites are reasons this species is valued by landowners and the nursery trade. This invasive tree tolerates very little shade (Kaufman and Kaufman 2007, Knapp and Canham 2000), but given adequate light, it can quickly become a nuisance. Tree-of-heaven is able to grow in heavily polluted areas and mine spoils and produce more than 300,000 winged seeds (Kaufman and Kaufman 2007). Within the forest this species is a concern in canopy gaps because of its rapid growth and allelopathic affects (Gould and Stuckey 1992, Heisey 1990, Kaufman and Kaufman 2007). Its rapid growth is problematic because this tree quickly matures, reproduces, and shades out native plant species.

In addition to spread by landowners and during mine reclamation, the presence of this species may also be attributed to deer. These hoofed animals browse the understory, creating disturbances which facilitate germination, and may contribute to the spread of tree-of-heaven, an unpalatable species (Knapp and Canham 2000, Rawinski 2008).

Aside from the negative aspects of tree-of-heaven, this tree has medicinal importance (Foster and Duke 2000). The bark is reported to be of value for diarrhea, dysentery, leucorrhea, and tapeworm, and it is also used in traditional Chinese medicine and for malaria. Tree-of-heaven has several antimalarial compounds, some of which are more potent than the standard antimalarial drug chloroquine. Even though there may be benefits to the use of this plant, caution must be used as this species produces sap which contains quassinoids that can cause dermatitis, heart problems, debilitating headaches, and nausea (Kaufman and Kaufman 2007).

According to the Plants Database (USDA, NRCS 2012), it is suggested this noxious tree can survive to -18.0 °F and requires cold stratification, 14.0 to 90.0 inches of precipitation annually, 150 or more frost free days, pH levels between 4.1 and 7.9, and a minimum rooting depth of 30.0 inches.

Figure 100.—Tree-of-heaven in flower. Photo by Jan Samanek, State Phytosanitary Administration, Bugwood.org.

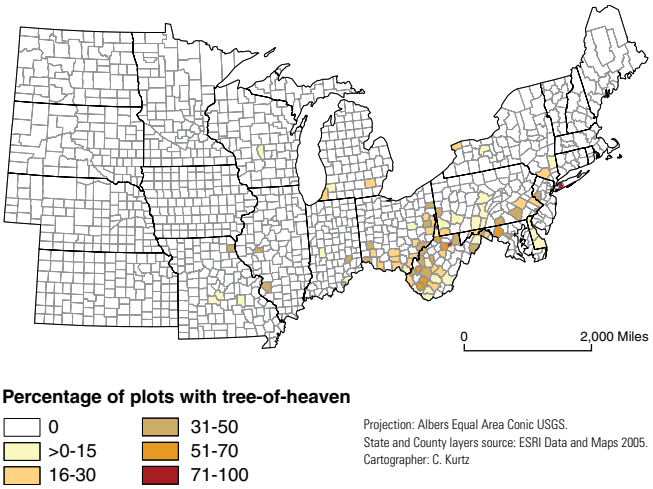

Figure 101.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2007-2010) and P3 plots (2005-2006) where tree-of-heaven was observed, by county.

Current distribution: Tree-of-heaven is now found in 42 states, with Connecticut listing it as invasive, Massachusetts and New Hampshire as prohibited, and Vermont as a Class B noxious weed; it is also found in two Canadian provinces, Ontario and Quebec (USDA, NRCS 2012).

P2 and P3 monitoring: Tree-of-heaven was monitored on NRS FIA P2 invasive plots from 2007 through 2010 and on P3 plots from 2005 through 2006. It was the 15th most commonly observed IPS, occurring on 132 of 7,107 plots (1.9 percent; Table 2). In this region, it primarily occurred in the southeast, with the greatest proportion of plots with tree-of-heaven present occurring in West Virginia (18.0 percent). There were 12 states in the NRS FIA region where tree-of-heaven was not observed (Fig. 101).

Winter creeper

(Euonymus fortunei)
EUFO5

Background and characteristics: Winter creeper, a woody vine of the bittersweet family (Celastraceae), was introduced as a groundcover from Asia in 1907 (Kaufman and Kaufman 2007, Miller et al. 2010). It possesses several characteristics which have helped it to become a successful invader such as cold, heat, and shade tolerance, aggressive growth, ability to root at the nodes, and fleshy seeds that are spread by birds, animals, and water (Miller et al. 2010). This plant is problematic because it forms dense foliar layers that shade out neighboring vegetation (Fig. 102).

The USDA PLANTS Database (USDA, NRCS 2012) suggests this noxious invader can survive to -13.0 °F and requires 32.0 to 55.0 inches of precipitation annually, 140 or more frost free days, pH levels between 5.0 and 7.5, and a minimum rooting depth of 18.0 inches. Additional growth limitations are its low tolerance of drought, saline, and anaerobic conditions and intolerance of fine and coarse textured soils.

Current distribution: Winter creeper is found in 23 states, primarily in the eastern United States, and one Canadian province, Ontario (USDA, NRCS 2012).

P2 and P3 monitoring: Winter creeper was monitored on NRS FIA P2 invasive plots from 2005 through 2006 and on P3 plots from 2005 through 2010. It was the 33rd most commonly observed IPS, occurring on 23 of 13,659 plots (0.2 percent; Table 2). This invasive vine was observed in five states of the NRS FIA region: Illinois, Indiana, Kansas, Missouri, and Ohio (Fig. 103).

Figure 102.—Winter creeper. Photo by James H. Miller, USDA Forest Service, Bugwood.org.

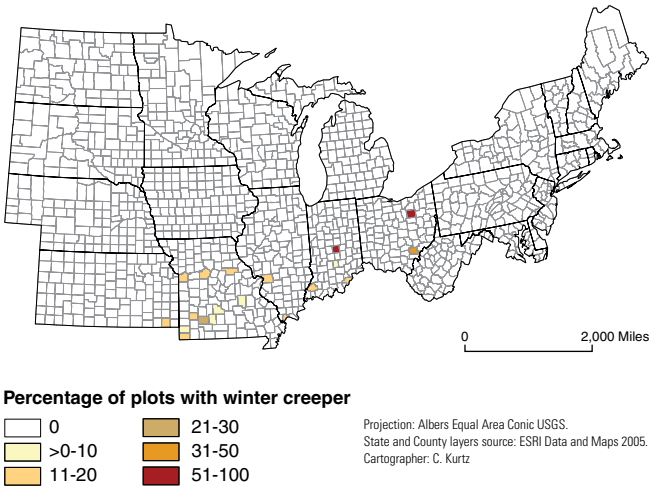

Figure 103.—Percentage of forested Forest Inventory and Analysis P2 Invasive plots (2005-2006) and P3 plots (2005-2010) where winter creeper was observed, by county.

Table 1.—Growth form, years surveyed, and the number of plots measured, by state, for selected invasive plant species in the

Invasive plant species		Years surveyed		Number of plots monitored by state								
Common name (Scientific name)	Growth form[a]	Phase 2 invasive plots[b]	Phase 3 plots[c]	CT	DE	IL	IN	IA	KS	ME	MD	MA
Common reed *(Phragmites australis)*	G	2005-2010	2005-2006	67	74	624	771	366	292	490	83	106
Nepalese browntop *(Microstegium vimineum)*	G	2005-2010	2005-2006	67	74	624	771	366	292	490	83	106
Reed canarygrass *(Phalaris arundinacea)*	G	2005-2010	2005-2006	67	74	624	771	366	292	490	83	106
Asiatic tearthumb *(Polygonum perfoliatum)*	H	2005-2006	2005-2010	17	56	506	467	308	228	168	20	26
Bohemian knotweed *(Polygonum xbohemicum)*	H	2007-2010	2005-2006	67	74	254	354	89	100	490	83	106
Bull thistle *(Cirsium vulgare)*	H	2007-2010	2005-2006	67	74	254	354	89	100	490	83	106
Canada thistle *(Cirsium arvense)*	H	2007-2010	2005-2006	67	74	254	354	89	100	490	83	106
Creeping jenny *(Lysimachia nummularia)*	H	2007-2010	2005-2006	67	74	254	354	89	100	490	83	106
Dames rocket *(Hesperis matronalis)*	H	2005-2010	2005-2006	67	74	624	771	366	292	490	83	106
European swallow-wort *(Cynanchum rossicum)*	H	2007-2010	2005-2006	67	74	254	354	89	100	490	83	106
Garlic mustard *(Alliaria petiolata)*	H	2005-2010	2005-2006	67	74	624	771	366	292	490	83	106
Giant knotweed *(Polygonum sachalinense)*	H	2007-2010	2005-2006	67	74	254	354	89	100	490	83	106
Japanese knotweed *(Polygonum cuspidatum)*	H	2005-2010	2005-2006	67	74	624	771	366	292	490	83	106
Leafy spurge *(Euphorbia esula)*	H	2005-2010	2005-2006	67	74	624	771	366	292	490	83	106
Lesser burdock *(Arctium minus)*	H	2005-2006	2005-2010	17	56	506	467	308	228	168	20	26
Louise's swallow-wort *(Cynanchum louiseae)*	H	2005-2010	2005-2006	67	74	624	771	366	292	490	83	106
Marsh thistle *(Cirsium palustre)*	H	2005-2006	2005-2010	17	56	506	467	308	228	168	20	26
Purple loosestrife *(Lythrum salicaria)*	H	2007-2010	2005-2006	67	74	254	354	89	100	490	83	106
Spotted knapweed *(Centaurea stoebe)*	H	2005-2010	2005-2006	67	74	624	771	366	292	490	83	106
Amur honeysuckle *(Lonicera maackii)*	S	2007-2010	2005-2006	67	74	254	354	89	100	490	83	106
Autumn olive *(Elaeagnus umbellata)*	S	2005-2010	2005-2006	67	74	624	771	366	292	490	83	106
Common barberry *(Berberis vulgaris)*	S	2007-2010	2005-2006	67	74	254	354	89	100	490	83	106
Common buckthorn *(Rhamnus cathartica)*	S	2005-2010	2005-2006	67	74	624	771	366	292	490	83	106
European cranberrybush *(Viburnum opulus)*	S	2007-2010	2005-2006	67	74	254	354	89	100	490	83	106
European privet *(Ligustrum vulgare)*	S	2005-2010	2005-2006	67	74	624	771	366	292	490	83	106
Glossy buckthorn *(Frangula alnus)*	S	2005-2010	2005-2006	67	74	624	771	366	292	490	83	106
Japanese barberry *(Berberis thunbergii)*	S	2005-2010	2005-2006	67	74	624	771	366	292	490	83	106

24 states monitored by the Northern Research Station Forest Inventory and Analysis program, 2005 though 2010

Number of plots monitored by state															
MI	MN	MO	NE	NH	NJ	NY	ND	OH	PA	RI	SD	VT	WV	WI	Total plots monitored
4,984	3,470	1,768	160	140	64	505	90	292	444	33	202	141	331	3,432	18,929
4,984	3,470	1,768	160	140	64	505	90	292	444	33	202	141	331	3,432	18,929
4,984	3,470	1,768	160	140	64	505	90	292	444	33	202	141	331	3,432	18,929
4,296	2,594	1,463	131	35	15	158	74	106	141	3	159	39	106	2,543	13,659
859	1,025	504	50	140	64	505	20	292	444	33	61	141	331	1,021	7,107
859	1,025	504	50	140	64	505	20	292	444	33	61	141	331	1,021	7,107
859	1,025	504	50	140	64	505	20	292	444	33	61	141	331	1,021	7,107
859	1,025	504	50	140	64	505	20	292	444	33	61	141	331	1,021	7,107
4,984	3,470	1,768	160	140	64	505	90	292	444	33	202	141	331	3,432	18,929
859	1,025	504	50	140	64	505	20	292	444	33	61	141	331	1,021	7,107
4,984	3,470	1,768	160	140	64	505	90	292	444	33	202	141	331	3,432	18,929
859	1,025	504	50	140	64	505	20	292	444	33	61	141	331	1,021	7,107
4,984	3,470	1,768	160	140	64	505	90	292	444	33	202	141	331	3,432	18,929
4,984	3,470	1,768	160	140	64	505	90	292	444	33	202	141	331	3,432	18,929
4,296	2,594	1,463	131	35	15	158	74	106	141	3	159	39	106	2,543	13,659
4,984	3,470	1,768	160	140	64	505	90	292	444	33	202	141	331	3,432	18,929
4,296	2,594	1,463	131	35	15	158	74	106	141	3	159	39	106	2,543	13,659
859	1,025	504	50	140	64	505	20	292	444	33	61	141	331	1,021	7,107
4,984	3,470	1,768	160	140	64	505	90	292	444	33	202	141	331	3,432	18,929
859	1,025	504	50	140	64	505	20	292	444	33	61	141	331	1,021	7,107
4,984	3,470	1,768	160	140	64	505	90	292	444	33	202	141	331	3,432	18,929
859	1,025	504	50	140	64	505	20	292	444	33	61	141	331	1,021	7,107
4,984	3,470	1,768	160	140	64	505	90	292	444	33	202	141	331	3,432	18,929
859	1,025	504	50	140	64	505	20	292	444	33	61	141	331	1,021	7,107
4,984	3,470	1,768	160	140	64	505	90	292	444	33	202	141	331	3,432	18,929
4,984	3,470	1,768	160	140	64	505	90	292	444	33	202	141	331	3,432	18,929
4,984	3,470	1,768	160	140	64	505	90	292	444	33	202	141	331	3,432	18,929

(Table 1 continued on next page)

(Table 1 continued)

Invasive plant species		Years surveyed		Number of plots monitored by state								
Common name (Scientific name)	Growth form[a]	Phase 2 invasive plots[b]	Phase 3 plots[c]	CT	DE	IL	IN	IA	KS	ME	MD	MA
Japanese meadowsweet *(Spiraea japonica)*	S	2007-2010	2005-2006	67	74	254	354	89	100	490	83	106
Morrow's honeysuckle *(Lonicera morrowii)*	S	2007-2010	2005-2006	67	74	254	354	89	100	490	83	106
Multiflora rose *(Rosa multiflora)*	S	2005-2010	2005-2006	67	74	624	771	366	292	490	83	106
Nonnative bush honeysuckles *(Lonicera* spp.*)*	S	2005-2006[d]	---	0	0	370	417	277	192	0	0	0
Showy fly honeysuckle *(Lonicera xbella)*	S	2007-2010	2005-2006	67	74	254	354	89	100	490	83	106
Tatarian honeysuckle *(Lonicera tatarica)*	S	2007-2010	2005-2006	67	74	254	354	89	100	490	83	106
Black locust *(Robinia pseudoacacia)*	T	2007-2010	2005-2006	67	74	254	354	89	100	490	83	106
Chinaberry *(Melia azedarach)*	T	2007-2010	2005-2006	67	74	254	354	89	100	490	83	106
Norway maple *(Acer platanoides)*	T	2007-2010	2005-2006	67	74	254	354	89	100	490	83	106
Princesstree *(Paulownia tomentosa)*	T	2007-2010	2005-2006	67	74	254	354	89	100	490	83	106
Punktree *(Melaleuca quinquenervia)*	T	2007-2010	2005-2006	67	74	254	354	89	100	490	83	106
Russian olive *(Elaeagnus angustifolia)*	T	2007-2010	2005-2006	67	74	254	354	89	100	490	83	106
Saltcedar *(Tamarix ramosissima)*	T	2007-2010	2005-2006	67	74	254	354	89	100	490	83	106
Siberian elm *(Ulmus pumila)*	T	2007-2010	2005-2006	67	74	254	354	89	100	490	83	106
Silktree *(Albizia julibrissin)*	T	2007-2010	2005-2006	67	74	254	354	89	100	490	83	106
Tallow tree *(Triadica sebifera)*	T	2007-2010	2005-2006	67	74	254	354	89	100	490	83	106
Tree-of-heaven *(Ailanthus altissima)*	T	2007-2010	2005-2006	67	74	254	354	89	100	490	83	106
Amur peppervine *(Ampelopsis brevipedunculata)*	V	2005-2006	2005-2010	17	56	506	467	308	228	168	20	26
Chinese yam *(Dioscorea oppositifolia)*	V	2005-2006	2005-2010	17	56	506	467	308	228	168	20	26
English ivy *(Hedera helix)*	V	2007-2010	2005-2006	67	74	254	354	89	100	490	83	106
Japanese honeysuckle *(Lonicera japonica)*	V	2005-2010	2005-2006	67	74	624	771	366	292	490	83	106
Kudzu *(Pueraria montana)*	V	2005-2006	2005-2010	17	56	506	467	308	228	168	20	26
Oriental bittersweet *(Celastrus orbiculatus)*	V	2005-2010	2005-2006	67	74	624	771	366	292	490	83	106
Winter creeper *(Euonymus fortunei)*	V	2005-2006	2005-2010	17	56	506	467	308	228	168	20	26

[a]Growth form: G-graminoid, H-herbaceous, S-shrub, T-tree, V-vine.

[b]P2 invasive plot data consist of both P2 invasive plots and data extracted from P3 plots; together these plots are referred to as P2 invasive plots.

[c]When P2 invasive plot data was not available for a particular inventory (e.g., Ohio 2005-2006) or species (e.g., English ivy 2005-2006), the invasive plant data were calculated solely from P3 plots.

[d]Data for nonnative bush honeysuckles were not included for 2007 through 2010 because nativity was not determined by field crew.

Number of plots monitored by state															
MI	MN	MO	NE	NH	NJ	NY	ND	OH	PA	RI	SD	VT	WV	WI	Total plots monitored
859	1,025	504	50	140	64	505	20	292	444	33	61	141	331	1,021	7,107
859	1,025	504	50	140	64	505	20	292	444	33	61	141	331	1,021	7,107
4,984	3,470	1,768	160	140	64	505	90	292	444	33	202	141	331	3,432	18,929
4,125	2,445	1,264	110	0	0	0	70	0	0	0	141	0	0	2,411	11,822
859	1,025	504	50	140	64	505	20	292	444	33	61	141	331	1,021	7,107
859	1,025	504	50	140	64	505	20	292	444	33	61	141	331	1,021	7,107
859	1,025	504	50	140	64	505	20	292	444	33	61	141	331	1,021	7,107
859	1,025	504	50	140	64	505	20	292	444	33	61	141	331	1,021	7,107
859	1,025	504	50	140	64	505	20	292	444	33	61	141	331	1,021	7,107
859	1,025	504	50	140	64	505	20	292	444	33	61	141	331	1,021	7,107
859	1,025	504	50	140	64	505	20	292	444	33	61	141	331	1,021	7,107
859	1,025	504	50	140	64	505	20	292	444	33	61	141	331	1,021	7,107
859	1,025	504	50	140	64	505	20	292	444	33	61	141	331	1,021	7,107
859	1,025	504	50	140	64	505	20	292	444	33	61	141	331	1,021	7,107
859	1,025	504	50	140	64	505	20	292	444	33	61	141	331	1,021	7,107
859	1,025	504	50	140	64	505	20	292	444	33	61	141	331	1,021	7,107
859	1,025	504	50	140	64	505	20	292	444	33	61	141	331	1,021	7,107
4,296	2,594	1,463	131	35	15	158	74	106	141	3	159	39	106	2,543	13,659
4,296	2,594	1,463	131	35	15	158	74	106	141	3	159	39	106	2,543	13,659
859	1,025	504	50	140	64	505	20	292	444	33	61	141	331	1,021	7,107
4,984	3,470	1,768	160	140	64	505	90	292	444	33	202	141	331	3,432	18,929
4,296	2,594	1,463	131	35	15	158	74	106	141	3	159	39	106	2,543	13,659
4,984	3,470	1,768	160	140	64	505	90	292	444	33	202	141	331	3,432	18,929
4,296	2,594	1,463	131	35	15	158	74	106	141	3	159	39	106	2,543	13,659

Table 2.—The number and percent of Forest Inventory and Analysis plots[a] where each invasive plant species was found, by

Common name (Scientific name)	CT	DE	IL	IN	IA	KS	ME	MD	MA	MI	MN	MO
Amur honeysuckle *(Lonicera maackii)*	---	3 (4.1%)	44 (17.3%)	30 (8.5%)	11 (12.4%)	6 (6.0%)	1 (0.2%)	2 (2.4%)	---	5 (0.6%)	1 (0.1%)	17 (3.4%)
Amur peppervine *(Ampelopsis brevipedunculata)*	---	---	---	---	---	---	---	---	---	---	---	---
Asiatic tearthumb *(Polygonum perfoliatum)*	---	---	---	---	---	---	---	2 (10.0%)	---	---	---	---
Autumn olive *(Elaeagnus umbellata)*	1 (1.5%)	3 (4.1%)	56 (9.0%)	86 (11.2%)	15 (4.1%)	1 (0.3%)	---	5 (6.0%)	1 (0.9%)	158 (3.2%)	1 (0.0%)	25 (1.4%)
Black locust *(Robinia pseudoacacia)*	1 (1.5%)	1 (1.4%)	14 (5.5%)	38 (10.7%)	4 (4.5%)	2 (2.0%)	---	14 (16.9%)	1 (0.9%)	7 (0.8%)	---	15 (3.0%)
Bohemian knotweed *(Polygonum xbohemicum)*	---	---	---	---	---	--	---	1 (1.2%)	---	---	---	---
Bull thistle *(Cirsium vulgare)*	---	---	2 (0.8%)	8 (2.3%)	5 (5.6%)	3 (3.0%)	9 (1.8%)	---	---	37 (4.3%)	35 (3.4%)	10 (2.0%)
Canada thistle *(Cirsium arvense)*	1 (1.5%)	---	3 (1.2%)	12 (3.4%)	1 (1.1%)	1 (1.0%)	6 (1.2%)	1 (1.2%)	---	77 (9.0%)	46 (4.5%)	2 (0.4%)
Chinaberry *(Melia azedarach)*	---	---	---	---	---	---	---	---	---	---	---	---
Chinese yam *(Dioscorea oppositifolia)*	---	---	2 (0.4%)	6 (1.3%)	---	---	---	---	---	---	---	1 (0.1%)
Common barberry *(Berberis vulgaris)*	---	---	---	8 (2.3%)	---	---	---	2 (2.4%)	3 (2.8%)	10 (1.2%)	---	---
Common buckthorn *(Rhamnus cathartica)*	2 (3.0%)	1 (1.4%)	38 (6.1%)	12 (1.6%)	21 (5.7%)	---	4 (0.8%)	2 (2.4%)	13 (12.3%)	43 (0.9%)	299 (6.6%)	10 (0.6%)
Common reed *(Phragmites australis)*	1 (1.5%)	2 (2.7%)	2 (0.3%)	1 (0.1%)	---	---	---	1 (1.2%)	---	8 (0.2%)	---	1 (0.1%)
Creeping jenny *(Lysimachia nummularia)*	---	---	2 (0.8%)	8 (2.3%)	1 (1.1%)	---	---	1 (1.2%)	---	4 (0.5%)	2 (0.2%)	---
Dames rocket *(Hesperis matronalis)*	---	---	2 (0.3%)	20 (2.6%)	2 (0.5%)	1 (0.3%)	---	---	---	3 (0.1%)	---	---
English ivy *(Hedera helix)*	---	---	---	1 (0.3%)	---	---	---	1 (1.2%)	---	---	---	---
European cranberrybush *(Viburnum opulus)*	---	---	2 (0.8%)	2 (0.6%)	---	---	1 (0.2%)	---	---	1 (0.1%)	1 (0.1%)	---
European privet *(Ligustrum vulgare)*	3 (4.5%)	2 (2.7%)	1 (0.2%)	22 (2.9%)	---	---	---	5 (6.0%)	1 (0.9%)	10 (0.2%)	---	2 (0.1%)
European swallow-wort *(Cynanchum rossicum)*	---	---	---	---	---	---	---	0 0 (0.0%)	---	---	---	---
Garlic mustard *(Alliaria petiolata)*	5 (7.5%)	4 (5.4%)	82 (13.0%)	111 (14.0%)	62 (17.0%)	39 (13.0%)	---	22 (27.0%)	3 (2.8%)	61 (1.2%)	4 (0.1%)	8 (0.5%)
Giant knotweed *(Polygonum sachalinense)*	---	---	---	---	---	---	---	---	---	1 (0.1%)	---	---
Glossy buckthorn *(Frangula alnus)*	---	---	6 (1.0%)	6 (0.8%)	---	---	7 (1.4%)	---	18 (17.0%)	33 (0.7%)	20 (0.6%)	---
Japanese barberry *(Berberis thunbergii)*	22 (32.8%)	2 (2.7%)	22 (3.5%)	11 (1.4%)	6 (1.6%)	---	7 (1.4%)	18 (21.7%)	19 (17.9%)	52 (1.0%)	4 (0.1%)	1 (0.1%)
Japanese honeysuckle *(Lonicera japonica)*	1 (1.5%)	30 (40.5%)	145 (23.2%)	170 (22.0%)	---	5 (1.7%)	---	32 (38.6%)	---	4 (0.1%)	1 (0.0%)	94 (5.3%)
Japanese knotweed *(Polygonum cuspidatum)*	1 (1.5%)	---	---	2 (0.3%)	1 (0.3%)	---	1 (0.2%)	1 (1.2%)	2 (1.9%)	1 (0.0%)	---	2 (0.1%)
Japanese meadowsweet *(Spiraea japonica)*	---	---	---	1 (0.3%)	---	---	---	---	---	---	---	---
Kudzu *(Pueraria montana)*	---	---	---	2 (0.4%)	---	---	---	---	---	---	---	1 (0.1%)
Leafy spurge *(Euphorbia esula)*	---	---	---	1 (0.1%)	---	---	---	---	---	2 (0.0%)	1 (0.0%)	1 (0.1%)

state, in the Northern Research Station from 2005 through 2010

NE	NH	NJ	NY	ND	OH	PA	RI	SD	VT	WV	WI	Plots monitored	Plots present	Percent constancy[b]
---	---	2 (3.1%)	8 (1.6%)	---	43 (14.7%)	27 (6.1%)	---	---	---	7 (2.1%)	10 (1.0%)	7,107	217	3.1
---	---	---	---	---	1 (0.9%)	1 (0.7%)	---	---	---	---	---	13,659	2	0.0
---	---	---	---	---	---	2 (1.4%)	---	---	---	1 (0.0%)	---	13,659	5	0.0
---	1 (0.7%)	6 (9.4%)	15 (3.0%)	---	36 (12.3%)	49 (11.0%)	2 (6.1%)	---	---	67 (20.2%)	25 (0.7%)	18,929	553	3.0
---	---	2 (3.1%)	17 (3.4%)	---	68 (23.3%)	58 (13.1%)	1 (3.0%)	---	1 (0.7%)	130 (39.3%)	8 (0.8%)	7,107	382	5.4
---	---	---	---	---	---	1 1 (0.2%)	---	---	---	---	---	7,107	2	0.0
2 (4.0%)	---	---	13 (2.6%)	2 (10.0%)	3 (1.0%)	10 (2.3%)	---	7 (11.5%)	2 (1.4%)	7 (2.1%)	29 (2.8%)	7,107	184	2.6
4 (8.0%)	---	--	9 (1.8%)	4 (20.0%)	12 (4.1%)	4 (0.9%)	---	7 (11.5%)	---	5 (1.5%)	36 (3.5%)	7,107	231	3.3
---	---	---	1 (0.2%)	---	---	---	---	---	---	---	---	7,107	1	0.0
---	---	---	---	---	---	---	---	---	---	---	---	13,659	9	0.1
---	---	---	3 (0.6%)	---	3 3 (1.0 %)	4 4 (0.9%)	---	---	6 (4.3%)	4 (1.2%)	---	7,107	43	0.6
1 (0.6%)	2 (1.4%)	1 (1.6%)	85 (16.8%)	6 (6.7%)	5 (1.7%)	3 (0.7%)	---	6 (3.0%)	7 (5.0%)	1 (0.3%)	344 (10.0%)	18,929	836	4.4
---	---	1 (1.6%)	7 (1.4%)	---	2 (0.7%)	---	---	---	---	---	2 (0.1%)	18,929	28	0.1
---	---	---	28 (5.5%)	---	23 (7.9%)	5 (1.1%)	---	---	5 (3.5%)	4 (1.2%)	11 (1.1%)	7,107	94	1.3
---	---	---	14 (2.8%)	---	4 (1.4%)	8 (1.8%)	---	---	---	1 (0.3%)	9 (0.3%)	18,929	64	0.3
---	---	---	---	---	---	1 (0.2%)	---	---	---	---	---	7,107	3	0.0
---	1 (0.7%)	---	2 (0.4%)	---	2 (0.7%)	---	---	---	---	---	4 (0.4%)	7,107	16	0.2
---	---	4 (6.3%)	9 (1.8%)	---	43 (14.7%)	25 (5.6%)	---	---	---	7 (2.1%)	---	18,929	134	0.7
---	---	---	1 (0.2%)	---	---	---	---	---	---	---	---	7,107	1	0.0
3 (1.9%)	---	13 (20.0%)	67 (13.0%)	---	88 (30.0%)	96 (22.0%)	---	---	---	33 (10.0%)	150 (4.4%)	18,929	851	4.5
---	---	---	---	---	---	2 (0.5%)	---	---	---	1 (0.3%)	---	7,107	4	0.1
---	6 (4.3%)	1 (1.6%)	20 (4.0%)	---	8 (2.7%)	3 (0.7%)	4 (12.1%)	---	2 (1.4%)	---	63 (1.8%)	18,929	197	1.0
---	3 (2.1%)	13 (20.3%)	34 (6.7%)	---	35 (12.0%)	100 (22.5%)	2 (6.1%)	---	4 (2.8%)	31 (9.4%)	72 (2.1%)	18,929	458	2.4
---	---	22 (34.4%)	---	---	92 (31.5%)	37 (8.3%)	---	1 (0.5%)	---	49 (14.8%)	4 (0.1%)	18,929	687	3.6
---	---	---	6 (1.2%)	---	1 (0.3%)	1 (0.2%)	1 (3.0%)	---	1 (0.7%)	4 (1.2%)	1 (0.0%)	18,929	26	0.1
---	---	---	1 (0.2%)	---	---	3 (0.7%)	---	---	---	7 7 (2.1%)	---	7,107	12	0.2
---	---	---	---	---	---	---	---	---	---	---	---	13,659	3	0.0
5 (3.1%)	---	1 (1.6%)	1 (0.2%)	3 (3.3%)	---	---	---	4 (2.0%)	---	2 (0.6%)	---	18,929	21	0.1

(Table 2 continued on next page)

(Table 2 continued)

Common name (Scientific name)	CT	DE	IL	IN	IA	KS	ME	MD	MA	MI	MN	MO
Lesser burdock *(Arctium minus)*	---	---	27 (5.3%)	12 (2.6%)	44 (14.3%)	2 (0.9%)	2 (1.2%)	---	---	21 (0.5%)	18 (0.7%)	8 (0.5%)
Louise's swallow-wort *(Cynanchum louiseae)*	---	---	---	---	---	---	---	---	1 (0.9%)	---	---	---
Marsh thistle *(Cirsium palustre)*	---	---	---	---	---	---	---	---	---	47 (1.1%)	1 (0.0%)	---
Morrow's honeysuckle *(Lonicera morrowii)*	4 (6.0%)	---	7 (2.8%)	---	5 (5.6%)	---	10 (2.0%)	2 (2.4%)	3 (2.8%)	5 (0.6%)	11 (1.1%)	5 (1.0%)
Multiflora rose *(Rosa multiflora)*	20 (29.9%)	14 (18.9%)	339 (54.3%)	503 (65.2%)	216 (59.0%)	53 (18.2%)	5 (1.0%)	31 (37.3%)	19 (17.9%)	215 (4.3%)	5 (0.1%)	704 (39.8%)
Nepalese browntop *(Microstegium vimineum)*	1 (1.5%)	7 (9.5%)	31 (5.0%)	89 (11.5%)	---	---	---	21 (25.3%)	2 (1.9%)	2 (0.0%)	---	8 (0.5%)
Nonnative bush honeysuckles *(Lonicera* spp.*)*	---	---	121 (32.7%)	83 (19.9%)	50 (18.1%)	4 (2.1%)	---	---	---	130 (3.2%)	19 (0.8%)	86 (6.8%)
Norway maple *(Acer platanoides)*	6 6 (9.0%)	2 (2.7%)	1 (0.4%)	---	---	---	2 (0.4%)	2 (2.4%)	5 (4.7%)	1 (0.1%)	---	---
Oriental bittersweet *(Celastrus orbiculatus)*	12 (17.9%)	3 (4.1%)	3 (0.5%)	27 (3.5%)	4 (1.1%)	1 (0.3%)	5 (1.0%)	8 (9.6%)	20 (18.9%)	8 (0.1%)	---	1 (0.1%)
Princesstree *(Paulownia tomentosa)*	---	1 (1.4%)	---	---	---	---	---	2 (2.4%)	---	---	---	---
Punktree *(Melaleuca quinquenervia)*	---	---	---	---	---	---	---	---	---	---	---	---
Purple loosestrife *(Lythrum salicaria)*	---	---	---	---	---	---	---	---	---	2 (0.2%)	4 (0.4%)	---
Reed canarygrass *(Phalaris arundinacea)*	1 (1.5%)	---	33 (5.3%)	28 (3.6%)	80 (21.9%)	4 (1.4%)	20 (4.1%)	---	1 (0.9%)	96 (1.9%)	119 (3.4%)	3 (0.2%)
Russian olive *(Elaeagnus angustifolia)*	1 (1.5%)	---	1 (0.4%)	2 (0.6%)	---	2 (2.0%)	---	1 (1.2%)	1 (0.9%)	8 (0.9%)	---	3 (0.6%)
Saltcedar *(Tamarix ramosissima)*	---	---	---	---	---	1 (1.0%)	---	---	---	---	---	---
Showy fly honeysuckle *(Lonicera xbella)*	1 (1.5%)	---	1 (0.4%)	---	2 (2.2%)	---	---	---	2 (1.9%)	8 (0.9%)	23 (2.2%)	---
Siberian elm *(Ulmus pumila)*	---	---	3 (1.2%)	1 (0.3%)	6 (6.7%)	5 (5.0%)	---	1 (1.2%)	---	7 (0.8%)	4 (0.4%)	---
Silktree *(Albizia julibrissin)*	---	---	---	---	---	---	---	---	---	---	---	2 (0.4%)
Spotted knapweed *(Centaurea stoebe)*	---	---	---	1 (0.1%)	1 (0.3%)	---	---	---	---	67 (1.3%)	6 (0.2%)	1 (0.1%)
Tallow tree *(Triadica sebifera)*	---	---	---	---	---	---	---	---	---	---	---	---
Tatarian honeysuckle *(Lonicera tatarica)*	---	1 (1.4%)	10 (3.9%)	10 (2.8%)	4 (4.5%)	---	---	1 (1.2%)	---	22 (2.6%)	20 (2.0%)	---
Tree-of-heaven *(Ailanthus altissima)*	---	3 (4.1%)	2 (0.8%)	4 (1.1%)	---	---	---	6 (7.2%)	---	3 (0.3%)	---	4 (0.8%)
Winter creeper *(Euonymus fortunei)*	---	---	2 (0.4%)	4 (0.9%)	---	1 (0.4%)	---	---	---	---	---	14 (1.0%)

[a]Both P2 invasive and P3 data are included as shown in Table 1.

[b]Proportion of plots where the species was recorded.

NE	NH	NJ	NY	ND	OH	PA	RI	SD	VT	WV	WI	Plots monitored	Plots present	Percent constancy[b]
6 (4.6%)	---	---	6 (3.8%)	10 (13.5%)	6 (5.7%)	8 (5.7%)	---	4 (2.5%)	1 (2.6%)	4 (3.8%)	125 (4.9%)	13,659	304	2.2
---	---	---	2 (0.4%)	---	---	---	---	---	---	---	1 (0.0%)	18,929	4	0.0
---	---	---	---	---	---	---	---	---	---	---	1 (0.0%)	13,659	49	0.4
---	---	5 (7.8%)	108 (21.4%)	---	11 (3.8%)	58 (13.1%)	1 (3.0%)	---	1 (0.7%)	19 (5.7%)	16 (1.6%)	7,107	271	3.8
4 (2.5%)	2 (1.4%)	26 (40.6%)	141 (27.9%)	---	249 (85.3%)	206 (46.4%)	7 (21.2%)	---	5 (3.6%)	181 (54.7%)	191 (5.6%)	18,929	3,136	16.6
---	---	15 (23.4%)	8 (1.6%)	---	37 (12.7%)	73 (16.4%)	---	---	---	106 (32.0%)	---	18,929	400	2.1
---	---	---	---	5 (7.1%)	---	---	---	---	---	---	269 (11.2%)	11,822	767	6.5
---	1 (0.7%)	4 (6.3%)	12 (2.4%)	---	2 (0.7%)	8 (1.8%)	---	---	---	---	2 (0.2%)	7,107	48	0.7
---	2 (1.4%)	7 (10.9%)	10 (2.0%)	---	22 (7.5%)	32 (7.2%)	8 (24.2%)	---	---	14 (4.2%)	7 (0.2%)	18,929	194	1.0
---	---	---	---	---	1 (0.3%)	2 (0.5%)	---	---	---	14 (4.2%)	---	7,107	20	0.3
---	---	---	---	---	---	---	---	---	---	---	---	7,107	0	0.0
---	---	---	8 (1.6%)	---	2 (0.7%)	1 (0.2%)	---	---	---	---	---	7,107	17	0.2
7 (4.4%)	1 (0.7%)	1 (1.6%)	29 (5.7%)	2 (2.2%)	6 (2.1%)	4 (0.9%)	---	---	---	3 (0.9%)	204 (5.9%)	18,929	642	3.4
2 (4.0%)	---	1 (1.6%)	---	1 (5.0%)	12 (4.1%)	7 (1.6%)	---	1 (1.6%)	---	---	3 (0.3%)	7,107	46	0.6
1 (2.0%)	---	---	---	---	---	---	---	---	---	---	---	7,107	2	0.0
---	---	---	5 (1.0%)	---	14 (4.8%)	1 (0.2%)	---	---	---	---	24 (2.4%)	7,107	81	1.1
7 (14.0%)	---	---	---	---	---	1 (0.2%)	---	1 (1.6%)	---	---	6 (0.6%)	7,107	42	0.6
---	---	---	---	---	---	---	---	---	---	---	---	7,107	2	0.0
---	---	1 (1.6%)	4 (0.8%)	1 (1.1%)	2 (0.7%)	5 (1.1%)	---	---	---	---	10 (0.3%)	18,929	99	0.5
---	---	---	---	---	---	---	---	---	---	---	---	7,107	0	0.0
---	---	1 (1.6%)	11 (2.2%)	1 (5.0%)	6 (2.1%)	11 (2.5%)	---	---	---	2 (0.6%)	9 (0.9%)	7,107	109	1.5
---	---	1 (1.6%)	5 (1.0%)	---	29 (9.9%)	15 (3.4%)	---	---	---	59 (18.0%)	1 (0.1%)	7,107	132	1.9
---	---	---	---	---	2 (1.9%)	---	---	---	---	---	---	13,659	23	0.2

Table 3.—The five[a] most frequently recorded invasive plant species on Northern Research Station Forest Inventory and

Common name (Scientific name)	CT	DE	IL	IN	IA	KS	ME	MD	MA	MI
Amur honeysuckle *(Lonicera maackii)*	---	3 (4.1%)	44 (17.3%)	---	11 (12.4%)	6 (6.0%)	---	---	---	---
Autumn olive *(Elaeagnus umbellata)*	---	3 (4.1%)	56 (9.0%)	86 (11.2%)	---	---	---	---	---	158 (3.2%)
Black locust *(Robinia pseudoacacia)*	---	---	---	---	---	---	---	---	---	---
Bull thistle *(Cirsium vulgare)*	---	---	---	---	---	3 (3.0%)	9 (1.8%)	---	---	37 (4.3%)
Canada thistle *(Cirsium arvense)*	---	---	---	---	---	---	---	---	---	77 (9.0%)
Common barberry *(Berberis vulgaris)*	---	---	---	---	---	---	---	---	---	---
Common buckthorn *(Rhamnus cathartica)*	---	---	---	---	---	---	---	---	13 (12.3%)	---
Creeping jenny *(Lysimachia nummularia)*	---	---	---	---	---	---	---	---	---	---
European privet *(Ligustrum vulgare)*	---	---	---	---	---	---	---	---	---	---
Garlic mustard *(Alliaria petiolata)*	5 (7.5%)	4 (5.4%)	82 (13.0%)	111 (14.0%)	62 (17.0%)	39 (13.0%)	---	22 (27.0%)	---	---
Glossy buckthorn *(Frangula alnus)*	---	---	---	---	---	---	7 (1.4%)	---	18 (17.0%)	---
Japanese barberry *(Berberis thunbergii)*	22 (32.8%)	---	---	---	---	---	7 (1.4%)	18 (21.7%)	19 (17.9%)	---
Japanese honeysuckle *(Lonicera japonica)*	---	30 (40.5%)	145 (23.2%)	170 (22.0%)	---	---	---	32 (38.6%)	---	---
Leafy spurge *(Euphorbia esula)*	---	---	---	---	---	---	---	---	---	---
Lesser burdock *(Arctium minus)*	---	---	---	---	44 44 (14.3%)	---	---	---	---	---
Morrow's honeysuckle *(Lonicera morrowii)*	---	---	---	---	---	---	10 (2.0%)	---	---	---
Multiflora rose *(Rosa multiflora)*	20 (29.9%)	14 (18.9%)	339 (54.3%)	503 (65.2%)	216 (59.0%)	53 (18.2%)	---	31 (37.3%)	19 (17.9%)	215 (4.3%)
Nepalese browntop *(Microstegium vimineum)*	---	7 (9.5%)	---	89 (11.5%)	---	---	---	21 (25.3%)	---	
Nonnative bush honeysuckles *(Lonicera* spp.*)*	---	---	121 (32.7%)	83 (19.9%)	50 (18.1%)	---	---	---	---	130 (3.2%)
Norway maple *(Acer platanoides)*	6 (9.0%)	---	---	---	---	---	---	---	---	---
Oriental bittersweet *(Celastrus orbiculatus)*	12 (17.9%)	3 (4.1%)	---	---	---	---	---	---	20 (18.9%)	---
Reed canarygrass *(Phalaris arundinacea)*	---	---	---	---	80 (21.9%)	---	20 (4.1%)	---	---	---
Russian olive *(Elaeagnus angustifolia)*	---	---	---	---	---	---	---	---	---	---
Showy fly honeysuckle *(Lonicera xbella)*	---	---	---	---	---	---	---	---	---	---
Siberian elm *(Ulmus pumila)*	---	---	---	---	---	5 (5.0%)	---	---	---	---
Tatarian honeysuckle *(Lonicera tatarica)*	---	---	---	---	---	---	---	---	---	22 (2.6%)
Tree-of-heaven *(Ailanthus altissima)*	---	3 (4.1%)	---	---	---	---	---	---	---	---
PLOTS										
Monitored	67	74	624	771	366	292	490	83	106	4,984
Invaded	36	35	449	608	298	102	59	54	47	684
Percent constancy	53.7	47.3	72.0	78.9	81.4	34.9	12.0	65.1	44.3	13.7

[a]The top five invasive plant species are the most commonly observed invasive species from those selected for monitoring (Table 1) by the Northern Research Station ranked among the five most commonly occurring species, a sixth species was noted since nonnative bush honeysuckles were coded at the genus level.

Analysis plots. Species are listed with the number and percentage of plots where they were observed, from 2005 through 2010.

MN	MO	NE	NH	NJ	NY	ND	OH	PA	RI	SD	VT	WV	WI
---	17 (3.4%)	---	---	---	---	---	43 (14.7%)	---	---	---	---	---	---
---	---	---	---	---	---	---	---	---	2 (6.1%)	---	---	67 (20.2%)	---
---	15 (3.0%)	---	---	---	---	---	68 (23.3%)	58 (13.1%)	---	---	---	130 (39.3%)	---
35 (3.4%)	10 (2.0%)	2 (4.0%)	---	---	---	2 (10.0%)	---	---	---	7 (11.5%)	---	---	---
46 (4.5%)	---	4 (8.0%)	---	---	---	4 (20.0%)	---	---	---	7 (11.5%)	---	---	---
---	---	---	---	---	---	---	---	---	---	---	6 (4.3%)	---	---
229 (6.6%)	---	---	2 (1.4%)	---	85 (16.8%)	6 (6.7%)	---	---	---	6 (3.0%)	7 (5.0%)	---	244 (10.0%)
---	---	---	---	---	---	---	---	---	---	---	5 (3.5%)	---	---
---	---	---	---	---	---	---	43 (14.7%)	---	---	---	---	---	---
---	---	---	---	13 (20.0%)	67 (13.0%)	---	88 (30.0%)	96 (22.0%)	---	---	---	---	150 (4.4%)
---	---	---	6 (4.3%)	---	---	---	---	---	4 (12.1%)	---	---	---	---
---	---	---	3 (2.1%)	13 (20.3%)	34 (6.7%)	---	---	100 (22.5%)	2 (6.1%)	---	4 (2.8%)	---	---
---	94 (5.3%)	---	---	22 (34.4%)	---	---	92 (31.5%)	---	---	---	---	---	---
---	---	---	---	---	---	---	---	---	---	4 (2.0%)	---	---	---
---	---	6 (4.6%)	---	---	---	10 (13.5%)	---	---	---	4 (2.5%)	---	---	125 (4.9%)
---	---	---	---	---	108 (21.4%)	---	---	58 (13.1%)	---	---	---	---	---
---	704 (39.8%)	---	2 (1.4%)	26 (40.6%)	141 (27.9%)	---	249 (85.3%)	206 (46.4%)	7 (21.2%)	---	5 (3.6%)	181 (54.7%)	191 (5.6%)
---	---	---	---	15 (23.4%)	---	---	---	73 (16.4%)	---	---	---	106 (32.0%)	---
---	86 (6.8%)	---	---	---	---	5 (7.1%)	---	---	---	---	---	---	269 (11.2%)
---	---	---	---	---	---	---	---	---	---	---	---	---	---
---	---	---	2 (1.4%)	---	---	---	---	---	8 (24.2)	---	---	---	---
119 (3.4%)	---	2 (4.4%)	---	---	---	---	---	---	---	---	---	---	204 (5.9%)
---	---	2 (4.0%)	---	---	---	1 (5.0%)	---	---	---	---	---	---	---
17 (2.2%)	---	---	---	---	---	---	---	---	---	---	---	---	---
---	---	7 (14.0%)	---	---	---	---	---	---	---	---	---	---	---
---	---	---	---	---	---	1 (5.0%)	---	---	---	---	---	---	---
---	---	---	---	---	---	---	---	---	---	---	---	59 (18.0%)	---
3,470	1,768	160	140	64	505	90	292	444	33	202	141	331	3,432
398	812	28	15	31	251	26	273	270	17	30	26	262	951
11.5	45.9	17.5	10.7	48.4	49.7	28.9	93.5	60.8	51.5	14.9	18.4	79.2	27.7

Forest Inventory and Analysis program. Both P2 invasive and P3 data are included, as shown in Table 1. When nonnative bush honeysuckles (*Lonicera* spp.)

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Appendix

Conversion factors for units of measure

Temperature

(9/5 °C) + 32 Converts °C to °F

5/9 (°F – 32) Converts °F to °C

Length

Multiply by .621 to convert km to mi

Multiply by 1.609 to convert mi to km

Multiply by .394 to convert cm to in

Multiply by 2.54 to convert in to cm

Area

Multiply by 2.47 to convert ha to acres

Multiply by .405 to convert acres to ha

Kurtz, Cassandra 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.

Invasive plant species are a worldwide concern due to the high ecological and economic costs associated with their presence. This document describes the plant characteristics and regional distribution of the 50 invasive plant species monitored from 2005 through 2010 on forested Phase 2 (P2) Forest Inventory and Analysis (FIA) plots in the 24 states of the Northern Research Station. Genus level data for nonnative bush honeysuckles (Lonicera species) are included from 2005 through 2006. The data are from plots that are monitored in forested areas for public and private ownership classes.

KEY WORDS: alien plants, exotic plants, exotic weeds, introduced plants, invasion, invasive plants, invasive species, invasive weeds, noxious plants

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