

An Assessment of Invasive Plant Species in New Hampshire Forests

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This publication is part of a series that provides an overview of the invasive plant species monitored on an extensive systematic network of plots measured by the Forest Inventory and Analysis (FIA) program of the U.S. Department of Agriculture, Forest Service, Northern Research Station (NRS). Previous research notes in this series provided an overview of the 24 states monitored by NRS FIA. This research note is the result of a collaboration with the New Hampshire Department of Natural and Cultural Resources, Division of Forests and Lands, and is the first to offer analysis of a single NRS state. The report features the presence and change of invasive plant species for the 2014 and 2021 inventories through state and county level reporting.

Invasive Species Background

Invasive plant species (IPS)¹ threaten ecological integrity with their aggressive growth habits and ability to outcompete native vegetation. IPS typically have competitive advantage over native species due to traits such as earlier leaf out, prolific reproductive capability, and fewer natural predators (Fahey and Flory 2021). Thus, IPS can dominate a site and decrease the presence of native species, which affects biodiversity in the area.

As one example, Frappier et al. (2003) found that the presence of glossy buckthorn in forested southeastern New Hampshire had greater impact on native seedling density and richness than any other site conditions such as canopy openness, pH, or soil texture and moisture. Glossy buckthorn alters the density of native woody seedlings and native herbaceous cover as shown in Figure 1.

Decreases in native plant biodiversity impact the availability of food and habitat that wildlife depend upon for survival or reproduction. Insects, in particular, can have very specific host specialization needs, with many species being reliant on a very narrow range of flora (Tallamy et al. 2021).

Invasive plant species can spread through many avenues, just like native plants. However, unlike native plants, once established, they can quickly takeover a site (Figs. 2 and 3). Depending on seed size, weight, and reproductive mechanism (sexual versus asexual), a species can disperse offspring through wind, water, or via animals (either through the digestive tract or by hitching a ride to other locations). Human behaviors and activities such as garden planting selections, recreational activities, and even our vehicles can facilitate the spread of IPS (Rew et al. 2018).

Invasive plant species are both a global and local issue which poses a management challenge; New Hampshire is not exempt from this. With the shifting of species' ranges due to climate change, new invasive species are migrating into New Hampshire, bringing with them increased economic and ecological burdens (Coville et al. 2021, Hanley and Roberts 2019, Holden et al. 2016). Early detection, and monitoring, are crucial components to management of IPS, especially for areas not yet exposed. New best management practices that take a whole-systems approach are being developed (Panetta et al. 2019).



Figure 1.—Glossy buckthorn (*Frangula alnus*) outcompeting native regeneration in the forest understory, Canterbury, New Hampshire. Courtesy photo by Pete Bowman, NH Division of Forests and Lands.



Figure 2.—Oriental bittersweet (*Celastrus orbiculatus*) overtaking a forest gap in Canterbury, New Hampshire. Courtesy photo by Pete Bowman, NH Division of Forests and Lands.



Figure 3.—Japanese barberry (*Berberis thunbergii*) establishing in a forest understory in Webster, New Hampshire. Courtesy photo by Larissa Robinov, NH Division of Forests and Lands.

Data Collection

To provide a better understanding of the data used in this assessment, the following is a brief overview of FIA survey plots (see Westfall et al. 2022). Sample plots consist of four subplots which together cover approximately 1/6 acre and are randomly located throughout the NRS region. The inventory only occurs on plots that fall within forest land² (Kurtz 2013). Each plot represents approximately 6,000 acres, with some states and national forests more heavily sampled than others.

Invasive plants have been monitored on FIA plots in New Hampshire since 2007 with sampling occurring during the leaf-on window from May through September. In addition to monitoring IPS, standard forest variables are also recorded (Westfall et al. 2022). For IPS in New Hampshire, FIA crews visited 139 for the 2014 cycle and 95 plots for the 2021 cycle (Table 1). Plot locations are permanent but changes in data collection, such as inventory intensity, can affect remeasurement in different cycles. In New Hampshire, 67 plots were measured in both 2014 and 2021; then, due to a change in inventory protocol between 2014 and 2021, some plots from 2014 (72) were not remeasured while other plots (28) were added in 2021 to maintain spatial standards.

Each Forest Inventory and Analysis region has a specific list of invasive plants to monitor based on stakeholder interest. This report focuses on the 44 IPS monitored by FIA in the NRS region.³ These are comprised of 43 taxa collected at the species level and one at the genus level (nonnative bush honeysuckle).

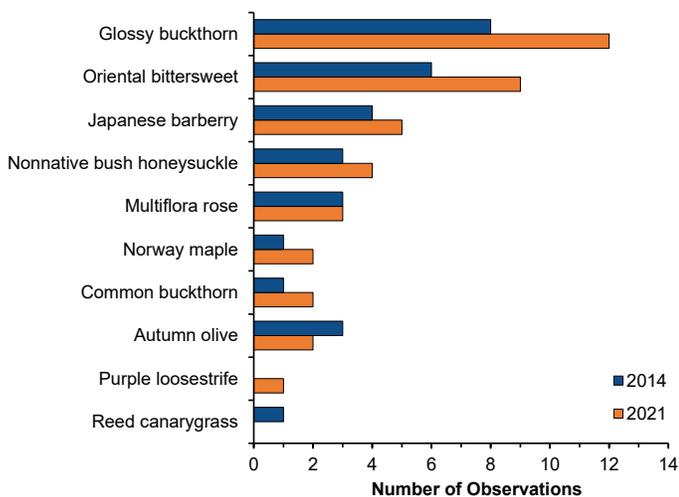


Figure 4.—Number of invasive plant species observed on phase 2 invasive plots in New Hampshire, 2014 and 2021.

It is important to note that the absence of invasive plant species in this report does not mean they do not exist in the region, but that they have not been found on the plots inventoried. Invasive plants can be common in nonforested areas such as wetlands, meadows, roadsides, and edge habitats, where sites are more susceptible to invasion. Such locations are monitored by other methods and programs. FIA plots only occur in forested habitats; therefore, this summary represents a different part of a bigger picture related to invasive species in New Hampshire.

Table 1.—Number and percentage of phase 2 invasive plots in New Hampshire with invasive plant species observed, 2014 and 2021

| Invasive Plant Species (IPS) | Number (percentage) of plots with IPS present, 2014 | Number (percentage) of plots with IPS present, 2021 |
|---|---|---|
| None found | 125 (90%) | 76 (80%) |
| Glossy buckthorn (<i>Frangula alnus</i>) | 8 (6%) | 12 (13%) |
| Oriental bittersweet (<i>Celastrus orbiculatus</i>) | 6 (4%) | 9 (9%) |
| Japanese barberry (<i>Berberis thunbergii</i>) | 4 (3%) | 5 (5%) |
| Autumn olive (<i>Elaeagnus umbellata</i>) | 3 (2%) | 4 (4%) |
| Multiflora rose (<i>Rosa multiflora</i>) | 3 (2%) | 3 (3%) |
| Nonnative bush honeysuckle (<i>Lonicera</i> spp.) | 3 (2%) | 2 (2%) |
| Common buckthorn (<i>Rhamnus cathartica</i>) | 1 (1%) | 2 (2%) |
| Norway maple (<i>Acer platanoides</i>) | 1 (1%) | 2 (2%) |
| Reed canarygrass (<i>Phalaris arundinacea</i>) | 1 (1%) | 0 (0%) |
| Purple loosestrife (<i>Lythrum salicaria</i>) | 0 (0%) | 1 (1%) |
| Total number of plots | 139 | 95 |

Results

During the two inventories (2014 and 2021) in New Hampshire, a total of ten invasive species were recorded in surveyed plots: autumn olive, common buckthorn, glossy buckthorn, Japanese barberry, multiflora rose, nonnative bush honeysuckle, Norway maple, oriental bittersweet, purple loosestrife, and reed canarygrass. The most commonly found species was glossy buckthorn with 12 observations in 2021 (Figure 4). This represents a seven percent increase from 2014 (Table 1). Oriental bittersweet followed closely at nine observations in 2021, a five percent increase from 2014. These changes led to a decrease in plots without IPS, from 90 percent in 2014 to 80 percent in 2021. Of the ten counties in New Hampshire, seven saw an increase of IPS presence on the surveyed plots (Table 2). Two counties saw a decrease in percent of IPS.

Table 2.—Number and percentage of phase 2 invasive plots with invasive plant species (IPS) observed in each county, 2014 and 2021

| County | Number of plots with IPS, 2014 | Total number of plots, 2014 | Percentage of plots with IPS, 2014 | Number of plots with IPS, 2021 | Total number of plots, 2021 | Percentage of plots with IPS, 2021 | Change in percentage of plots with IPS since 2014 |
|--------------|--------------------------------|-----------------------------|------------------------------------|--------------------------------|-----------------------------|------------------------------------|---|
| Belknap | 4 | 10 | 40% | 3 | 7 | 43% | 3% |
| Carroll | 0 | 18 | 0% | 1 | 11 | 9% | 9% |
| Cheshire | 1 | 12 | 8% | 4 | 10 | 40% | 32% |
| Coos | 0 | 30 | 0% | 0 | 18 | 0% | 0% |
| Grafton | 1 | 28 | 4% | 1 | 19 | 5% | 2% |
| Hillsborough | 2 | 9 | 22% | 1 | 6 | 17% | -6% |
| Merrimack | 6 | 14 | 43% | 3 | 9 | 33% | -10% |
| Rockingham | 0 | 7 | 0% | 2 | 7 | 29% | 29% |
| Strafford | 0 | 5 | 0% | 1 | 3 | 33% | 33% |
| Sullivan | 0 | 6 | 0% | 3 | 5 | 60% | 60% |

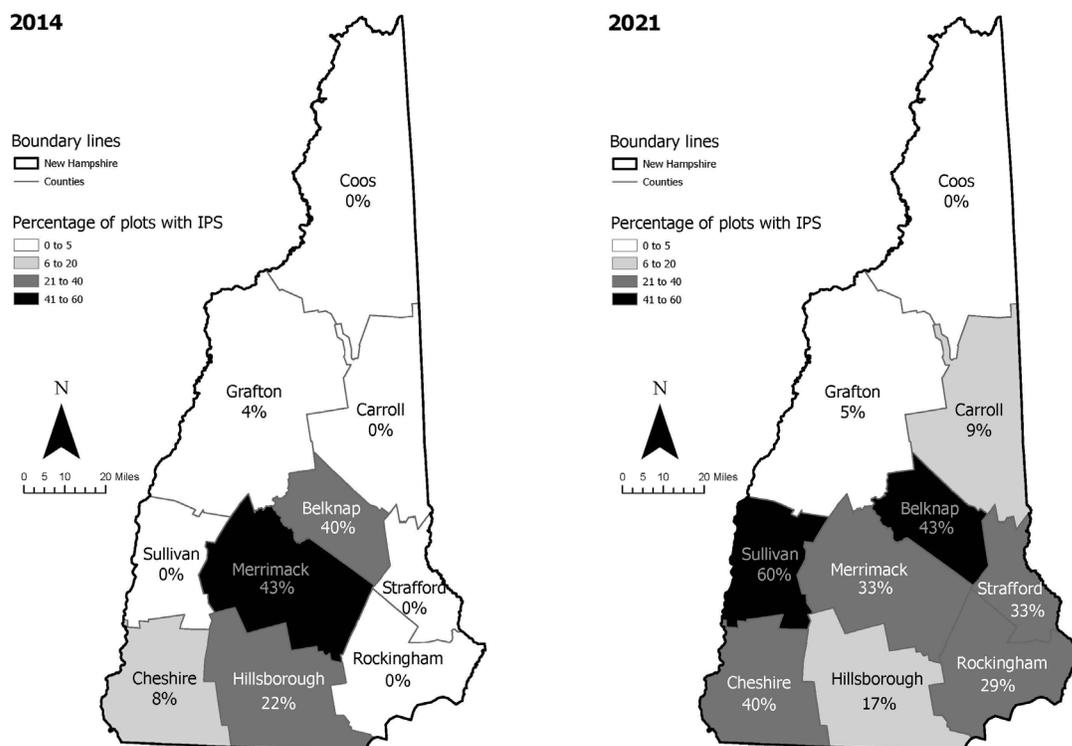


Figure 5.—Percentage of phase 2 invasive plots with invasive plant species present by county, New Hampshire, 2014 and 2021.

Conclusion

Overall, New Hampshire has seen a slight increase in the presence of invasive species on our forested landscape plots between 2014 and 2021. The three most prevalent species found on FIA plots in 2014 remained the most prevalent in 2021: glossy buckthorn, oriental bittersweet, and Japanese barberry. As Figure 5 and Table 2 show, all counties in the state, except for Coos County, saw a change in percent of plots with IPS. Hillsborough and Merrimack Counties saw a decrease in IPS presence which was surprising given the population density and levels of disturbance in those counties. The remaining seven counties in NH saw an increase in percent of plots with invasives present ranging from a 2 to 60 percent increase. The differences observed between the two years could be a result of the low sample size. Fewer samples are less representative, and with that, percent changes likely fall within the sampling error and would therefore be considered statistically insignificant change. County-level breakdowns do offer us important information but should be considered with the overall state trends because, at the local scale, sample sizes can be limited.

The surveyed plots in Coos County continue to remain at zero percent IPS presence, however several invasive plant species are known to be within the county. IPS species are commonly found along habitat edges, transportation corridors, on disturbed sites, and in open areas that are often not included in FIA inventories. For example, Appendix A in New Hampshire Forest Action Plan – 2020 (NH DNCR 2020) shows much higher levels of invasive plant species around the state. A select list of IPS are monitored in these FIA plots (Kurtz 2013) based on stakeholder interest and are standard for the 24 states in the NRS region.

Proactive and reactive management of IPS are important in stopping their spread, however care must be taken in removal efforts so as not to cause further damage or open the site up to secondary invasion (Pearson et al. 2016). Monitoring is a crucial tool to catching initial signs of IPS presence, changes over time, and reactions to management strategies. The phrase ‘the earlier the better’ holds true when it comes to managing IPS both economically and ecologically, although those metrics can be difficult to quantify (Coville et al. 2021, Hanley and Roberts 2019). Early detection improves management effectiveness considerably (Fahey and Flory 2021, Holden et al. 2016). Ongoing monitoring acts as a first line of defense for homeowners and landscape managers and enables adaptability in management practices which saves costs by identifying areas of concern before invasives have time to overtake the existing community.

What Can You Do?

- Learn to identify the invasive species of concern in your area and educate your neighbors and friends. Manage invasive species when you see them in your backyard.
- Do not plant invasive species, ask your local nursery for native species to plant instead. Build up resiliency in the existing native community to increase ability of natural ecosystems to resist invasion and keep IPS abundances below impact thresholds (Panetta et al. 2019).
- Clean your boots and vehicles of any plant material before leaving or entering a new location to decrease chances of IPS spread in our communities.

Other Resources

New Hampshire Department of Agriculture, Markets and Food

[Invasive Plants | Plant Industry | NH Department of Agriculture, Markets and Food](#)

New Hampshire Department of Agriculture, Markets and Food; New Hampshire Department of Environmental Services. 2023. **New Hampshire comprehensive invasive plant list**. Concord, NH. <https://www.agriculture.nh.gov/publications-forms/documents/nh-invasive-plant-list.pdf> (accessed December 2023).

University of New Hampshire Extension

[Invasive Species | Extension \(unh.edu\)](#)

[Spotlight on NH Invasive Plants | Extension \(unh.edu\)](#)

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Notes

¹ Hereafter IPS may also be referred to as “invasive species,” “invasive plants,” or “invasives.”

² The Forest Service, Forest Inventory and Analysis program defines forest land as land with at least 10 percent canopy cover by trees of any size, including land that formerly had such tree cover and that will be naturally or artificially regenerated. Forest land includes transition zones, such as areas between heavily forested and nonforested lands that are at least 10 percent canopy cover with trees and forest areas adjacent to urban and built-up lands. The minimum area for classification of forest land is 1 acre and 120 feet wide measured stem-to-stem from the outer-most edge. Unimproved roads and trails, streams, and clearings in forest areas are classified as forest if less than 120 feet wide. This is the domestic reporting definition which is different from the definition used in international reporting (which includes a minimum tree canopy height criteria).

³ List of invasive species monitored by Northern Research Station, Forest Inventory and Analysis: Amur honeysuckle (*Lonicera maackii*); autumn olive (*Elaeagnus umbellata*); black locust (*Robinia pseudoacacia*); Bohemian knotweed (*Polygonum x bohemicum*); bull thistle (*Cirsium vulgare*); Canada thistle (*Cirsium arvense*); Chinaberrytree (*Melia azedarach*); common barberry (*Berberis vulgaris*); common buckthorn (*Rhamnus cathartica*); common reed (*Phragmites australis*); creeping jenny (*Lysimachia nummularia*); dames rocket (*Hesperis matronalis*); English ivy (*Hedera helix*); European cranberrybush (*Viburnum opulus*); European privet (*Ligustrum vulgare*); European swallow-wort (*Cynanchum rossicum*); garlic mustard (*Alliaria petiolata*); giant knotweed (*Polygonum sachalinense*); glossy buckthorn (*Frangula alnus*); Japanese barberry (*Berberis thunbergii*); Japanese honeysuckle (*Lonicera japonica*); Japanese knotweed (*Polygonum cuspidatum*); Japanese meadowsweet (*Spiraea japonica*); Japanese stiltgrass (*Microstegium vimineum*); leafy spurge (*Euphorbia esula*); Louise's swallow-wort (*Cynanchum louiseae*); multiflora rose (*Rosa multiflora*); Morrow's honeysuckle (*Lonicera morrowii*); nonnative bush honeysuckle (*Lonicera* spp.); Norway maple (*Acer platanoides*); oriental bittersweet (*Celastrus orbiculatus*); princess tree (*Paulownia tomentosa*); punktree (*Melaleuca quinquevneria*); purple loosestrife (*Lythrum salicaria*); reed canarygrass (*Phalaris arundinacea*); Russian olive (*Elaeagnus angustifolia*); saltcedar (*Tamarix ramosissima*); showy fly honeysuckle (*Lonicera x bella*); Siberian elm (*Ulmus pumila*); silktree (*Albizia julibrissin*); spotted knapweed (*Centaurea stoebe* ssp. *micranthos*); tallow tree (*Triadica sebifera*); tatarian honeysuckle (*Lonicera tatarica*); tree of heaven (*Ailanthus altissima*).