Inventory shows extent of non-native invasive plants in Minnesota forests

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Readers are no doubt aware of the impact that non-native invasive plants (NNIP) present to Minnesota's ecosystems. The U.S. Forest Service's Northern Research Station (NRS) Forest Inventory and Analysis (FIA) Program is studying what determines where these plants are found, including forest type, tree density, disturbance, productivity, and topography.

Over the past decade, the NRS-FIA program has measured NNIP over a large network of inventory plots. Minnesota's forest inventory is "double intensity," meaning that there are two plots for every 6,000 acres, and field crews search for 25 species that are considered the worst NNIP on four 24-foot-radius subplots at each forested plot location.

The following list represents those species our stakeholders believe are likely to have a significant impact within 11 states of the Upper Midwest, including Minnesota. Inventory results provide information on individual tree species, diameter, and height. Measurements of overstory basal area and stand density index provide estimates of density.

Non-native invasive plants surveyed on FIA plots, 2005-2006

Woody species

Multiflora rose, *Rosa multiflora*
Japanese barberry, *Berberis thunbergii*
Common buckthorn, *Rhamnus cathartica*
Autumn olive, *Elaeagnus umbellata*
Nonnative bush, *Lonicera* spp.
European privet, *Ligustrum vulgare*

Vines

Kudzu, *Pueraria montana*
Porcelain berry, *Ampelopsis*
Asian bittersweet, *Celastrus orbiculatus*
Japanese honeysuckle, *Lonicera japonica*
Chinese yam, *Dioscorea*
Black swallowwort, *Cynanchum louiseae*
Wintercreeper, *Euonymus fortunei*

Grasses

Reed canary grass, *Phalaris*
Phragmites, Common reed, *Phragmites*
Nepalese browntop, Japanese, *Microstegium*

Herbaceous

Garlic mustard, *Alliaria petiolata*
Leafy spurge, *Euphorbia esula*
Spotted knapweed, *Centaurea*
Dame's rocket, *Hesperis matronalis*
Mile-a-minute weed, Asiatic, *Polygonum*
Common burdock, *Arctium minus*
Japanese knotweed, *Polygonum*
Marsh thistle, *Cirsium palustre*

The locations of NRS-FIA plots with non-native invasive plants in Minnesota's forests are shown in the map. Woody invasive species were particularly common, while the few herbaceous NNIP observed were located along the oak/prairie ecotone.

Of the 2,445 plots sampled in this study so far, only about 5 percent had one or more of the 25 invasive species of interest. Only nine of the NNIP on our list were observed and only one — common buckthorn (125 plots) — was found in large numbers. Some of the most prominent forest types in our state, such as aspen, black spruce, and paper birch, had few instances of the invasive plant species. The forest types with the most observations of invasive plants in Minnesota — white oak/red oak/hickory and sugarberry/hackberry/elm/green ash — are either mid-shade tolerant species that rely upon disturbance to maintain their position, or riparian species subject to frequent anthropogenic disturbance over their range.

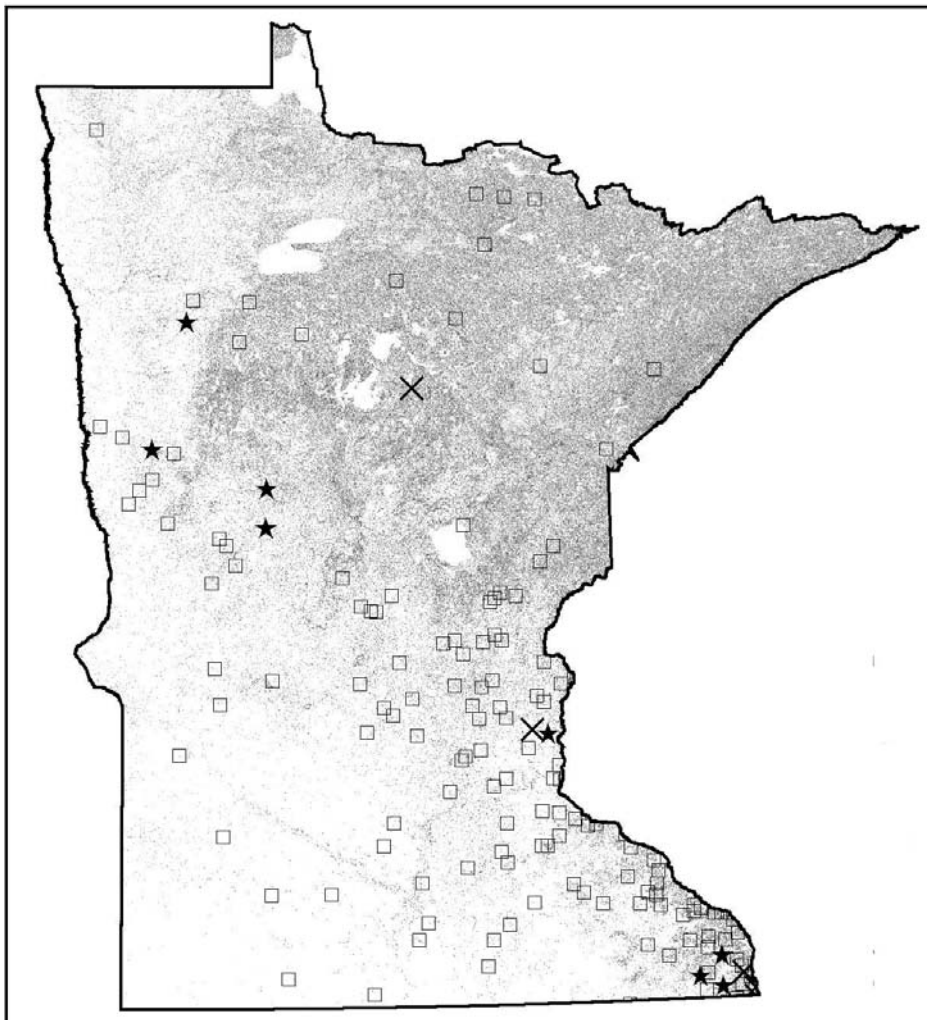
Species of NNIP found in Minnesota forested plots, 2005-2006.

The number of forested plots on which each species was found is in parentheses.

Most prominent species:
Common buckthorn (125)
Non-native bush honeysuckles (22)
Common burdock (10)
Reed canary grass (4)
Japanese barberry (3)
Multiflora rose (2)
Garlic mustard (2)
Glossy buckthorn (1)
Autumn olive (1)
Marsh thistle (1)

Given the history of natural and human-caused disturbance and forest types whose shade tolerance means the growing space might not be completely occupied, the authors expected to find multiple relationships between NNIP and forest and site characteristics.

In a regional study, Moser et al. (2008) found that measurements of disturbance and fragmentation were significantly related to NNIP presence and cover. The percentage of total county area in forests was very closely related to the presence of almost every one of the 25 species; the higher the percentage of forest, the less likely one would find invasive plants.



Cartographer Mark Nelson, Forest Inventory and Analysis, USDA Forest Service, Northern Research Station, prepared this map, using FIA and ESRI data and maps.

A combination of fragmentation measures (Heilmann et al. 2001) was positively associated with the presence of common buckthorn, multiflora rose, and non-native bush honeysuckles, as well as reed canary grass. Distance from the nearest road seemed to have a significant negative association.

These results suggest that site productivity was good for multiflora rose coverage in the Upper Midwest and was negatively associated with non-native bush honeysuckle coverage. While certain measures of density and stand age seemed to be negatively correlated with (any) NNIP presence and abundance, Moser et al. (2008) did not find as strong relationships with individual invasive plant species.

Our challenge is separating human influence from some ecological advantage of the invading plants. One could easily argue that our results reflect the heavily disturbed nature of Minnesota's second- and third-generation forests. The characteristics of the landscape that we found to influence invasive species presence may also be a significant influence on homestead choice by settlers.

Analysis of invasive species at one point in time is usually not sufficient to evaluate trends in regeneration, expansion, or growth. The FIA database tracks disturbance and silvicultural treatments, but only in the interval since the previous inventory. The human activities that resulted in the establishment of these non-native invasive species likely occurred many years ago. We are presently conducting a region-wide analysis using inventory and weather data and other information sources to follow up on our initial measurements and analysis.

Prairie restoration techniques studied at Lamberton

How can native prairies be more successfully recreated? Reseachers at the University of Minnesota's Southwest Research and Outreach Center at Lamberton are seeking answers.

Experiments at test plots in the center's 30-acre native prairie restoration site will help determine better ways to restore native grasses and forbs. So far, inclusion of cool-season grasses in seed mixes seems to be critical, and fall planting works best.

How can non-native, invasive Canada thistles be best controlled? Researchers are testing whether herbicides can be used selectively to reduce thistle growth without excessive damage to native forbs.

A third project seeks to stop native grasses, which grow quickly, from preventing slower-growing forbs from being establishd. The solution to this problem has not yet been found.