Prioritizing range-shifting invasive plants

High-impact species coming to the Northeast

Summary

Prevention of new invasions is a cost-effective way to manage invasive species and is most effective when emerging invaders are identified and prioritized before they arrive. Climate change is projected to bring nearly 100 new invasive plants to the Northeast. However, these plants are likely to have different types of impacts, making some a higher concern than others. Here, we summarize the results of original RISCC research that identifies high priority, range-shifting invasive plants based on their potential impacts.

Why is risk higher in the Northeast?

Because invasive plants are more prevalent in states to our south and many species are shifting their ranges poleward in response to climate warming, the Northeast is a hotspot of risk from range-shifting species (red areas in Figure 1). A study by Allen & Bradley (2016) modeled the current and potential ranges by 2050 for 896 invasive plants in the continental U.S. Up to 100 new invasive plants are likely to shift into Northeast states with climate change.

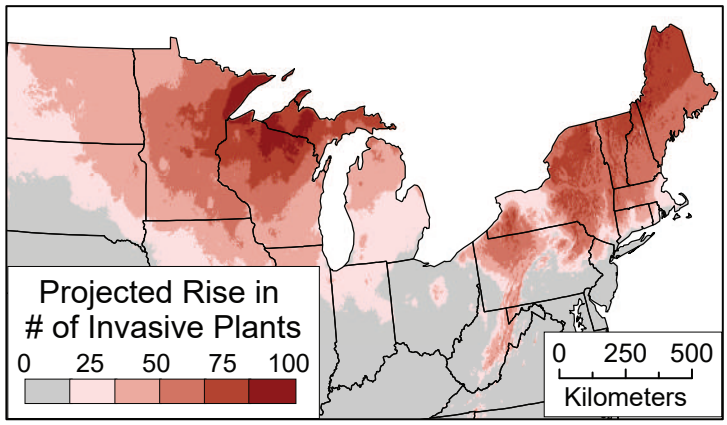


Fig 1. Projected number of new invasive plants by 2050.

Range-shifting invasive plants assessed for impacts

We assessed all non-native, invasive plants that are rare or absent in Connecticut, Massachusetts, New York, or Rhode Island but projected to expand into the region by 2050. Based on the scientific literature through 2018, **red species have 'major' impacts** on native community diversity, **orange species have 'moderate' impacts** on single-species populations, **blue species have 'minor' impacts** that don't affect species populations.
Note: understudied species may have higher impacts than currently reported.

Anthriscus caucalis
Ardisia elliptica
Arundo donax
Avena barbata
Cardaria chalepensis #
Carthamus lanatus #
Cortaderia selloana
Cunninghamia lanceolata #
Ehrharta erecta
Hemarthria altissima
Ludwigia grandiflora
Pinus pinaster
Rubus ulmifolius
Rubus vestitus #
Tamarix aphylla
Tamarix chinensis
Trifolium hirtum #
Ventenata dubia

Achyranthes japonica
Alyssum murale
Araujia sericifera
Asclepias curassavica
Bellardia trixago
Brachypodium distachyon
Cardaria pubescens
Centranthus ruber
Cestrum diurnum
Ceratocephala testiculata
Conyza bonariensis
Cytisus striatus
Dalbergia sissoo
Daphne laureola
Festuva brevipila
Hedera helix ssp. canariensis
Hedera hibernica
Hypericum calycinum
Lagerstroemia indica
Ligustrum japonicum

Lotus pedunculatus
Lythrum virgatum
Mahonia bealei
Nandina domestica
Oplismenus hirtellus
Paspalum urvillei
Peganum harmala
Persea americana
Prunus laurocerasus
Quercus acutissima
Senna occidentalis
Sesbania punicea
Sinapis arvensis
Spartium junceum
Stellaria media
Tamarix africana

Alhagi maurorum
Aegilops ovata
Anchusa arvensis

Arum italicum
Avena sterilis
Buddleja lindleyana
Carduus tenuiflorus
Centaurea iberica
Centaurea melitensis
Crotalaria spectabilis
Elaeagnus pungens
Firmiana simplex
Hibiscus tiliaceus
Leontodon taraxacoides
Phyllostachys aurea
Poncirus trifoliata
Prunus lusitanica
Pseudognaphalium luteoalbum
Rumex stenophyllus
Sacciolepis indica
Stachys arvensis
Vitis vinifera
Youngia japonica

Low confidence that 'major' impacts are caused by the invasive plant (e.g., reported impacts are anecdotal)

Measuring potential impact

The Environmental Impact Classification of Alien Taxa (EICAT) assesses the magnitude of invasive species' impacts using the scientific literature. This protocol was developed in consultation with the International Union for Conservation of Nature (IUCN) and was formally adopted as their method for classifying environmental impacts of alien species. We performed EICAT assessments on 100 range-shifting invasive plants (Rockwell-Postel et al. In Review). **Major Impact** species negatively affected native communities (i.e. a decline in native species richness, diversity, evenness, or the abundance of multiple species). Below, we highlight high impact species shifting or expanding into southern New England as well as their likelihood of affecting Northeast ecosystems.

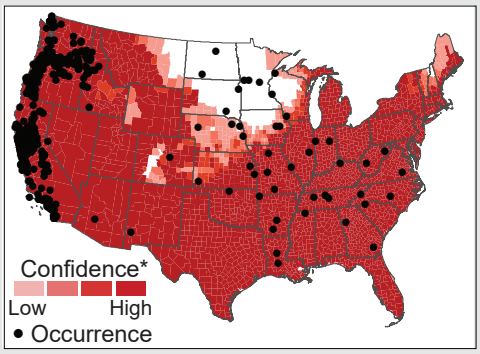
Want to perform an EICAT assessment? This tutorial will help you get started https://doi.org/10.7275/jx9a-ft39

Major impact species *most likely* to affect Northeast ecosystems

Anthriscus caucalis (bur chervil)

HIGH Impact: Outcompetes native plants in grasslands and forest edges. Closely related to wild chervil (*Anthriscus sylvestris*).

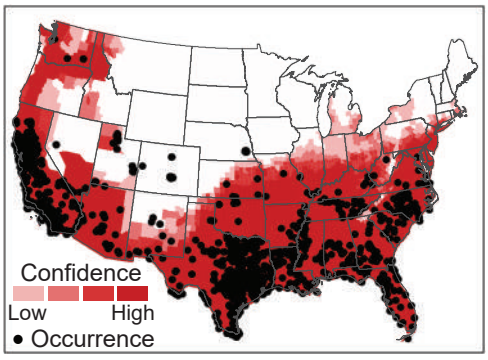
HIGH Vulnerability: Invades disturbed areas across the U.S. and Canada, but more prevalent in the Western U.S. Easily spreads on animals and equipment.



Arundo donax (giant reed)

HIGH Impact: Outcompetes native wetland plants, alters wetland structure, increases fire frequency, acts as a host for crop pests and pathogens.

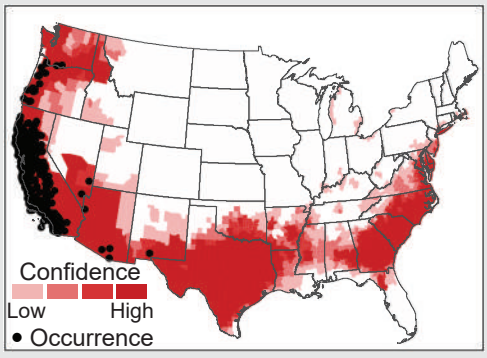
HIGH Vulnerability: Invades rivers, streams, wetlands, and coastal areas. Widely introduced as a biofuel crop, could arrive quickly. Difficult to control and spreads by rhizomes along waterways.



Avena barbata (slender wild oat)

HIGH Impact: Outcompetes native grassland species. Hosts crop pathogens (e.g., wheat crown rust)

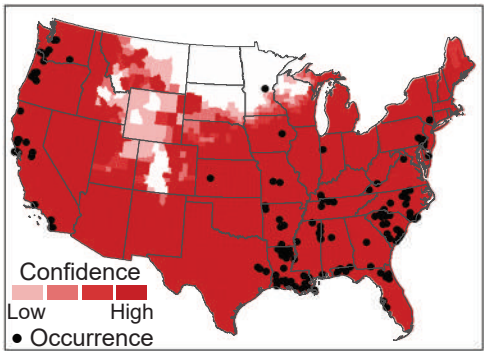
HIGH Vulnerability: Invades grasslands, crop systems, and disturbed fields. Introduced as a fodder crop and crop contaminant. Chemical or mechanical removal prior to seed production may be effective.



Ludwigia grandiflora (water primrose)

HIGH Impact: Outcompetes native plants, creates anoxic water conditions, and increases flood risk.

HIGH Vulnerability: Invades wetlands and water bodies. Introduced as an ornamental, could arrive quickly - it has already been identified in New York. Propagules spread easily via waterways, boats, and wildlife. Chemical control can be locally effective.

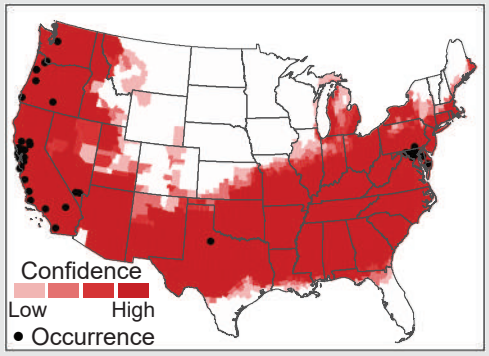


*Confidence refers to the number of models projecting future climatic suitability for the species

Rubus ulmifolius (elmleaf blackberry)

HIGH Impact: Outcompetes natives, creates dense thickets, threatens native endemic *Rubus* species through hybridization, and hosts crop diseases.

HIGH Vulnerability: Invades forests and pastures, including in the Northeast (populations in Delaware). Introduced as an ornamental; could arrive quickly. Mechanical and chemical control somewhat effective.

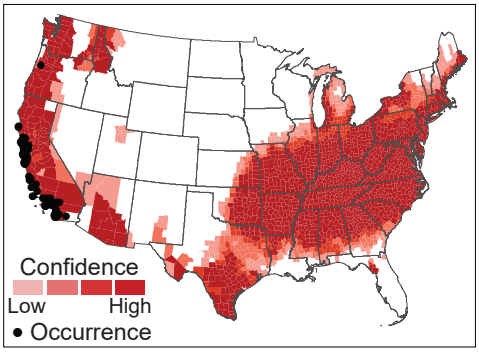


Major impact species *less likely* to affect Northeast ecosystems

Ardisia elliptica (shoebutton ardisia)

HIGH Impact: Forms dense stands, outcompetes and replaces native plants. Dominates forest canopy.

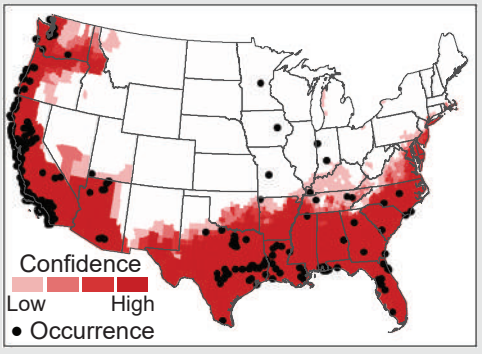
LOW Vulnerability: Invades tropical habitats. Model projection for the Northeast is likely flawed due to low numbers of distribution points. Prolific fruit production and seeds spread by birds and bats. Introduced as an ornamental.



Cortaderia selloana (Pampas grass)

HIGH Impact: Outcompetes native species, reduces macroinvertebrate diversity, and alters wetland structure.

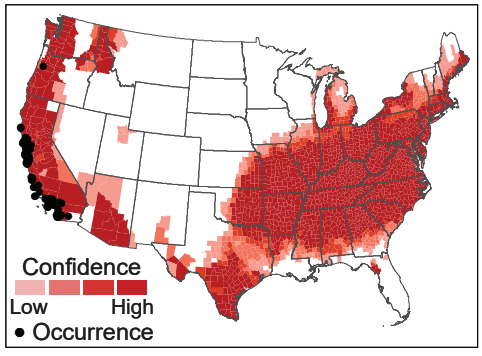
MEDIUM Vulnerability: Largest impacts are in Mediterranean coastal ecosystems, with lower impacts in forests, grasslands, and wetlands. Introduced as an ornamental; could arrive quickly.



Ehrharta erecta (panic veldtgrass)

HIGH Impact: Reduces cover of native shrubs, grasses, and forbs. Dense litter layer prevents germination of native seedlings.

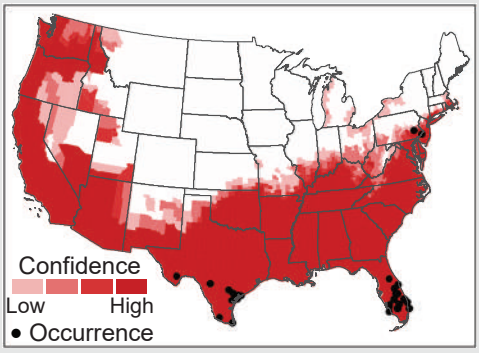
MEDIUM Vulnerability: Currently found in California where it invades grassland, disturbed areas and turf grass. Northeast grasslands might be vulnerable if the species is introduced. Accidentally introduced and transported along disturbance corridors.



Hemarthria altissima (limpograss)

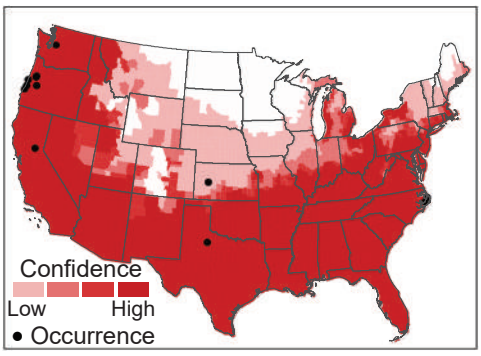
HIGH Impact: Outcompetes native wetland plants via the creation of dense monocultures and the production of allelopathic compounds.

MEDIUM Vulnerability: Invades wetlands and wet prairie grassland. Introduced as a pasture grass in Florida. Managed with glyphosate or grazing.



Major impact species *less likely* to affect Northeast ecosystems (cont'd)

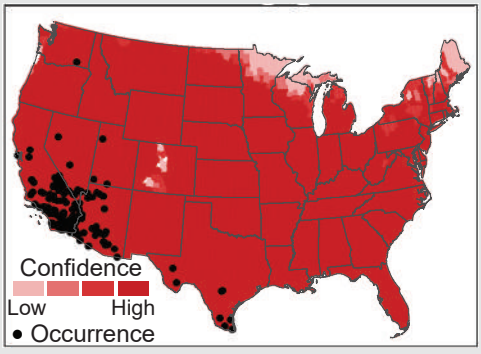
Pinus pinaster (maritime pine)



HIGH Impact: Outcompetes native plants; changes habitat structure and water availability by increasing tree cover.

LOW Vulnerability: Impacts are mainly in Mediterranean shrubland systems. Unlikely to have similar impacts in Northeast forests. Introduced in plantations and as an ornamental. Mechanical control can be effective.

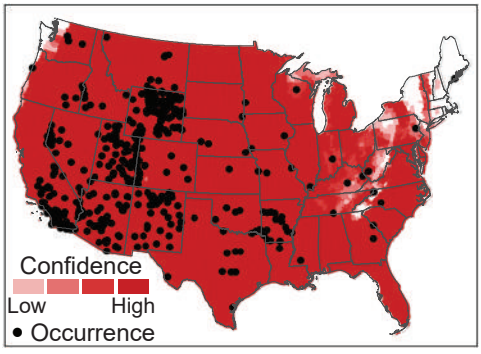
Tamarix aphylla (athel tamarisk)



HIGH Impact: Outcompetes and crowds out native plants, alters stream hydrology.

MEDIUM Vulnerability: Primarily invades in drier wetland and river systems of the western U.S., so Northeast might be less vulnerable. Introduced as an ornamental; could arrive quickly. Mechanical control requires excavating stumps.

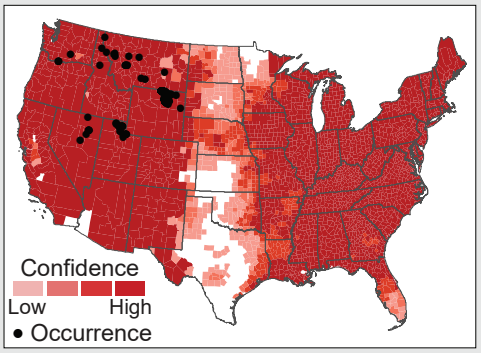
Tamarix chinensis (five stamen tamarisk)



HIGH Impact: Outcompetes and crowds out native plants, poor habitat for native birds.

MEDIUM Vulnerability: Primarily invades drier wetland and river systems of the western U.S., so Northeast might be less vulnerable. Introduced as an ornamental; could arrive quickly. Biocontrol is a potential option.

Ventenata dubia (wiregrass)



HIGH Impact: Reduces native plant diversity in shrublands and grasslands. Reduces quality and quantity of hay and forage crops.

MEDIUM Vulnerability: Primarily invades wetlands within semi-arid shrubland in the western U.S., so Northeast might be less vulnerable. Spreads easily on equipment and in disturbed areas. Difficult to control.

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References:
Allen & Bradley 2016 Biol. Conserv.; Blackburn et al. 2014 Glob. Change Biol.; Hawkins et al. 2015 Div. Distrib.; Rockwell-Postel et al. 2020 Biol. Invasions

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