Double Trouble
Understanding risks from invasive species + climate change

Summary
Individually, invasive species and climate change are major threats to global ecosystems. Together they create new challenges for effective management. Before we can design management strategies to respond to this double trouble, we need to understand how these two forms of global change interact.

Why is risk higher in the Northeast?
All regions are likely to see interactions between invasive species and climate change (Figure 1). The Northeast is particularly vulnerable for the following reasons:

- Northerly latitudes are warming more than southerly latitudes, leading to more rapid environmental changes.
- Substantial urban and suburban development cause atmospheric CO₂ content to increase more rapidly in the Northeast compared to more rural areas, increasing the competitiveness of invasive plants.
- Trends towards more extreme precipitation are more pronounced in the Northeast than any other region of the U.S., increasing disturbance and stress to native ecosystems.
- Prevalent southerly invasives are shifting their ranges north, making the Northeast a future invasion hotspot.

Figure 1. Major interactions between non-native invasive species and climate change.
New introduction pathways
- The rapid decline in Arctic sea ice is opening new shipping routes that directly connect east Asia to the Northeast U.S.
- Direct shipping could increase the introductions of novel aquatic and forest pests.

Photo: Ballast and packing materials transport pests.

Climate extremes create opportunities for invasion
- Extreme droughts, floods, and hurricanes create novel disturbances and opportunities for invasion.
- Drought stress increases tree susceptibility to secondary pathogens, making trees more vulnerable to invasive pests.

Photo: Drought + pathogen + defoliator stress increases tree mortality.

Invasives shift their ranges into new ecosystems
- Increasing temperatures cause many species to shift their ranges northward and upward in elevation.
- New animal pests, pathogens, and ~100 invasive plants are expected to shift into the Northeast.

Photo: Nutria and water primrose - coming to a waterway near you.

Shifting seasons promote invasions
- Milder winters increase pest survival.
- Invasive plants are more likely to shift the timing of green-up and brown-down in response to longer growing seasons, giving them a competitive advantage.

Photo: Climate change favors invasive milfoil and hemlock woolly adelgid.

Invasives become more competitive
- Warming or elevated CO₂ causes invasive plants to grow faster and produce more biomass than native plants.
- Invasive plants are often native to warmer regions, making them preadapted to climate warming.

Photo: Oriental bittersweet & common reed may be more competitive.

Herbicides become less effective
- Rising CO₂ causes some weeds to invest more energy in root growth and rebound after management.
- Higher temperatures lower plant transpiration, which reduces herbicide assimilation and efficacy.

Photo: Canada thistle is harder to kill with higher CO₂.

Management recommendations
★ Monitor for new invasive species (find watch lists at people.umass.edu/riscc/).
★ Look for alternative management strategies if herbicides become less effective.
★ Keep the timing of management flexible to respond to shifting seasons and extreme events.
★ Advocate for stronger policies to reduce new invasive species introductions.


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